

N O T I C E

NO HAND CARRIED BIDS! NO MAILED BIDS!

Current security requirements established by the U.S. Capitol Police to screen mail being delivered to the U.S. Capitol Complex of buildings preclude the use of U.S. Postal Service by offerors to deliver their proposals submitted in response to this solicitation. In addition, because all packages must be screened for security purposes at a central location prior to their delivery, the Architect of the Capitol cannot accept packages containing offers handcarried directly to the Bid Room address within the Ford House Office Building, as specified elsewhere in this solicitation, or at any other location in the U.S. Capitol Complex of buildings.

Due to these unusual circumstances the Procurement Division for the Architect of the Capitol will only accept offers/proposals via UPS or FEDEX. See provision AOC52.215-1 Instructions to Offerors located in Section L for solicitations for services/supplies or the Solicitation Conditions for solicitations for construction. All handcarried offers/proposals will be rejected. Any attempt to handcarry an offer/proposal to any location in the U.S. Capitol Complex of buildings will be refused. Offerors are advised when sending proposals via FEDEX or UPS ***not*** to use same day delivery. FEDEX/UPS often subcontract out the delivery for same-day service. It is necessary for delivery personnel to arrive in a FEDEX/UPS truck and be in a uniform recognized as FEDEX/UPS. Offerors are encouraged to determine who will be making the delivery when making arrangements with FEDEX/UPS.

NOTICE TO CONTRACTORS

The Architect of the Capitol anticipates that in 2006 the agency's contractors will have to register with the Central Contractor Registration (CCR) database. This is the primary vendor database for the U.S. Federal Government and the CCR collects, validates, stores, and disseminates data in support of agency acquisition missions.

Registration in the CCR will become mandatory in order to be awarded contracts by the Federal Government. Vendors are required to complete a one-time registration to provide basic information relevant to procurement and financial transactions. Vendors must update or renew their registration at least once per year to maintain an active status.

CCR validates the vendor information and electronically shares the secure and encrypted data with the federal agencies finance offices to facilitate paperless payments through electronic funds transfer (EFT).

The AOC is now encouraging all vendors to register with the CCR if they are not already registered. Vendors can register on line at <http://www.ccr.gov>. This internet site contains all pertinent information for registration as well as provides contact points for help when registering.



UNITED STATES CAPITOL BUILDING EMERGENCY ELECTRICAL SERVICE

March 09, 2007

Architect of the Capitol
United States Capitol
Washington, D.C. - 20515

PROJECT MANUAL

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ISSUED BY: ARCHITECT OF THE CAPITOL

UNITED STATES CAPITOL BUILDING EMERGENCY ELECTRICAL SERVICE

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VOLUME I

BUSINESS

SOLICITATION, OFFER, AND AWARD <i>(Construction, Alteration, or Repair)</i> Architect of the Capitol		1. SOLICITATION NO. RFP070086	2. TYPE OF SOLICITATION <input type="checkbox"/> SEALED BID (IFB) <input checked="" type="checkbox"/> NEGOTIATED (RFP)	3. DATE ISSUED 03/09/2007	PAGE 1 OF 44 PAGES
IMPORTANT -The "offer" section on the reverse must be fully completed by offeror.					
4. CONTRACT NO.	5. REQUISITION/PURCHASE REQUEST NO. CB 070059	6A. PROJECT NO. 020188	6B. TITLE 020188, Emergency Electrical Service Upgrade, CB		
7. ISSUED BY AOC - Procurement Division 2nd & D Streets, SW Room H2-263 WASHINGTON, DC 20515		8. ADDRESS OFFER TO			
9. FOR INFORMATION CALL:		a. NAME Ryan Kirkwood	b. TELEPHONE NUMBER (Include area code)(NO COLLECT CALLS) 202-226-1947		

SOLICITATION

NOTE: In sealed bid solicitations "offer" and "offeror" means "bid" and "bidder".

10. THE GOVERNMENT REQUIRES PERFORMANCE OF THE WORK DESCRIBED IN THESE DOCUMENTS (Title, identifying no., date)

11. The Contractor shall begin performance 30 calendar days and complete it within 495 calendar days after receiving
☐ award, ☒ notice to proceed. This performance period is ☒ mandatory ☐ negotiable. (*See* _____.)

12a. THE CONTRACTOR MUST FURNISH ANY REQUIRED PERFORMANCE AND PAYMENT BONDS? (If "YES," indicate within how many calendar days after award in Item 12b).

☒ YES ☐ NO

12b. CALENDAR DAYS

20

13. ADDITIONAL SOLICITATION REQUIREMENTS

- a. Sealed offers in original and 1 copies to perform the work required are due at the place specified in item 8 by 5:00PM (hour) local time 04/09/2007 (date). If this is a sealed bid solicitation, offers will be publicly opened at that time. Sealed envelopes containing offers shall be marked to show the offeror's name and address, the solicitation number, and the date and time offers are due.
- b. An offer guarantee ☒ is, ☐ is not required.
- c. All offers are subject to the (1) work requirements, and (2) other provisions and clauses incorporated in the solicitation in full text or by reference
- d. Offers providing less than 60 calendar days for Government acceptance after the date offers are due will not be considered and will be rejected.

OFFER (Must be fully completed by offeror)

14. NAME AND ADDRESS OF OFFEROR (Include ZIP Code) CODE	15. TELEPHONE NO. (Include area code)
	16. REMITTANCE ADDRESS (Include only if different than Item 14.)

17. The offeror agrees to perform the work required at the prices specified below in strict accordance with the terms of this solicitation, if this offer is accepted by the Government in writing within 60 calendar days after the date offers are due. (Insert any number equal to or greater than the minimum requirement stated in Item 13d. Failure to insert any number means the offeror accepts the minimum in Item 13d.)

18. The offeror agrees to furnish any required performance and payment bonds.

19. ACKNOWLEDGMENT OF AMENDMENTS

(The offeror acknowledges receipt of amendments to the solicitation -- give number and date of each)

AMENDMENT NO.											
DATE											
20a. NAME AND TITLE OF PERSON AUTHORIZED TO SIGN OFFER (Type or print)					20b. SIGNATURE					20c. OFFER DATE	

AWARD (To be completed by Government)

21. ITEMS ACCEPTED

22. AMOUNT	23. ACCOUNTING AND APPROPRIATION DATA
24. SUBMIT INVOICES TO ADDRESS SHOWN IN ITEM (4 copies unless otherwise specified)	25. OTHER THAN FULL AND OPEN COMPETITION PURSUANT TO 41 U.S.C. 5
26. ADMINISTERED BY AOC - Procurement Division 2nd & D Streets, SW Room H2-263 WASHINGTON, DC 20515	27. PAYMENT WILL BE MADE BY Accounting Division Ford House Office Bldg. Rm. H2-205 Washington, DC 20515

CONTRACTING OFFICER WILL COMPLETE ITEM 28 OR 29 AS APPLICABLE

<input type="checkbox"/> 28. NEGOTIATED AGREEMENT (Contractor is required to sign this document and return _____ copies to issuing office) Contractor agrees to furnish and deliver all items or perform all work requirements identified on this form and any continuation sheets for the consideration stated in this contract. The rights and obligations of the parties to this contract shall be governed by (a) this contract award, (b) the solicitation, and (c) the clauses, representations, certifications, and specifications incorporated by reference in or attached to this contract.		<input type="checkbox"/> 29. AWARD (Contractor is required to sign this document.) Your offer on this solicitation is hereby accepted as to the items listed. This award consummates the contract, which consists of (a) the Government solicitation and your offer, and (b) this contract award. No further contractual document is necessary.	
30a. NAME AND TITLE OF CONTRACTOR OR PERSON AUTHORIZED TO SIGN (Type or print)		31a. NAME OF CONTRACTING OFFICER (Type or print) Ryan I. Kirkwood	
30b. SIGNATURE	30c. DATE	31b. UNITED STATES OF AMERICA BY _____	31c. DATE SIGNED

Summary Info Continuation Page

BASE

Number	Commodity Name	Quantity	Unit of Issue	Unit Price (\$)	Total Cost (\$, Inc. disc)
1	General Construction Contract	Total : 1.00	LT	\$	\$
Description: The Contractor shall furnish all supplies, equipment, personnel and services necessary to perform the work for the procurement and installation of a new 13.2 KV wiring and an emergency Diesel Generator System with associated equipment for the United States Capitol Building. The work includes new primary feeders to the House and Senate sides of the Capitol's new emergency substations. The work also includes the removal of two (2) existing 230KW Generators including the outdoor generator remote radiators to be turnover the to AOC and delivered to AOC designated storage facilities (within 50 miles) for the Emergency Electrical Service, United States Capitol, Washington, D.C. (see the SPECIFICATIONS AND THE CONTRACT DRAWINGS) as required by the Architect of the Capitol.					
Lump-Sum Price for Base					\$

General Conditions

Sec. E 52.252-1

52.252-1 SOLICITATION PROVISIONS INCORPORATED BY REFERENCE (FEB 1998)

This solicitation incorporates one or more solicitation provisions by reference, with the same force and effect as if they were given in full text. Upon request, the Contracting Officer will make their full text available. The offeror is cautioned that the listed provisions may include blocks that must be completed by the offeror and submitted with its quotation or offer. In lieu of submitting the full text of those provisions, the offeror may identify the provision by paragraph identifier and provide the appropriate information with its quotation or offer. Also, the full text of a solicitation provision may be accessed electronically at this/these address(es):

www.gsa.gov or www.arnet.gov

(End of provision)

52.211-12

Liquidated Damages--Construction (Sept 2000)

(a) If the Contractor fails to complete the work within the time specified in the contract, the Contractor shall pay liquidated damages to the Government in the amount of \$1,450.00 for each calendar day of delay until the work is completed or accepted.

(b) If the Government terminates the Contractor's right to proceed, liquidated damages will continue to accrue until the work is completed. These liquidated damages are in addition to excess costs of repurchase under the Termination clause.

(End of clause)

52.222-26 Alt I

Equal Opportunity (Apr 2002) - Alternate I (Feb 1999)

Notice: The following terms of this clause are waived for this contract: [Contracting Officer shall list terms] .

(a) *Definition.* "United States," as used in this clause, means the 50 States, the District of Columbia, Puerto Rico, the Northern Mariana Islands, American Samoa, Guam, the U.S. Virgin Islands, and Wake Island.

(b) If, during any 12-month period (including the 12 months preceding the award of this contract), the Contractor has been or is awarded nonexempt Federal contracts and/or subcontracts that have an aggregate value in excess of \$10,000, the Contractor shall comply with paragraphs (b)(1) through (b)(11) of this clause, except for work performed outside the United States by employees who were not recruited within the United States. Upon request, the Contractor shall provide information necessary to determine the applicability of this clause.

(1) The Contractor shall not discriminate against any employee or applicant for employment because of race, color, religion, sex, or national origin. However, it shall not be a violation of this clause for the Contractor to extend a publicly announced preference in employment to Indians living on or near an Indian reservation, in connection with employment opportunities on or near an Indian reservation, as permitted by 41 CFR 60-1.5.

(2) The Contractor shall take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, color, religion, sex, or national origin. This shall include, but not be limited to--

(i) Employment;

(ii) Upgrading;

(iii) Demotion;

(iv) Transfer;

(v) Recruitment or recruitment advertising;

(vi) Layoff or termination;

(vii) Rates of pay or other forms of compensation; and

(viii) Selection for training, including apprenticeship.

(3) The Contractor shall post in conspicuous places available to employees and applicants for employment the notices to be provided by the Contracting Officer that explain this clause.

(4) The Contractor shall, in all solicitations or advertisements for employees placed by or on behalf of the Contractor, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, or national origin.

(5) The Contractor shall send, to each labor union or representative of workers with which it has a collective bargaining agreement or other contract or understanding, the notice to be provided by the Contracting Officer advising the labor union or workers' representative of the Contractor's commitments under this clause, and post copies of the notice in conspicuous places available to employees and applicants for employment.

(6) The Contractor shall comply with Executive Order 11246, as amended, and the rules, regulations, and orders of the Secretary of Labor.

(7) The Contractor shall furnish to the contracting agency all information required by Executive Order 11246, as amended, and by the rules, regulations, and orders of the Secretary of Labor. The Contractor shall also file Standard Form 100 (EEO-1), or any successor form, as prescribed in 41 CFR Part 60-1. Unless the Contractor has filed within the 12 months preceding the date of contract award, the Contractor shall, within 30 days after contract award, apply to either the regional Office of Federal Contract Compliance Programs (OFCCP) or the local office of the Equal Employment Opportunity Commission for the necessary forms.

(8) The Contractor shall permit access to its premises, during normal business hours, by the contracting agency or the OFCCP for the purpose of conducting on-site compliance evaluations and complaint investigations. The Contractor shall permit the Government to inspect and copy any books, accounts, records (including computerized records), and other material that may be relevant to the matter under investigation and pertinent to compliance with Executive Order 11246, as amended, and rules and regulations that implement the Executive Order.

(9) If the OFCCP determines that the Contractor is not in compliance with this clause or any rule, regulation, or order of the Secretary of Labor, this contract may be canceled, terminated, or suspended in whole or in part and the Contractor may be declared ineligible for further Government contracts, under the procedures authorized in Executive Order 11246, as amended. In addition, sanctions may be imposed and remedies invoked against the Contractor as provided in Executive Order 11246, as amended; in the rules, regulations, and orders of the Secretary of Labor; or as otherwise provided by law.

(10) The Contractor shall include the terms and conditions of paragraphs (b)(1) through (11) of this clause in every subcontract or purchase order that is not exempted by the rules, regulations, or orders of the Secretary of Labor issued under Executive Order 11246, as amended, so that these terms and conditions will be binding upon each subcontractor or vendor.

(11) The Contractor shall take such action with respect to any subcontract or purchase order as the Contracting Officer may direct as a means of enforcing these terms and conditions, including sanctions for noncompliance, provided, that if the Contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of any direction, the Contractor may request the United States to enter into the litigation to protect the interests of the United States.

(c) Notwithstanding any other clause in this contract, disputes relative to this clause will be governed by the procedures in 41 CFR 60-1.1.

(End of clause)

52.228-14

Irrevocable Letter of Credit (Dec 1999)

(a) "Irrevocable letter of credit (ILC)," as used in this clause, means a written commitment by a federally insured financial institution to pay all or part of a stated amount of money, until the expiration date of the letter, upon presentation by the Government (the beneficiary) of a written demand therefor. Neither the financial institution nor the offeror/Contractor can revoke or condition the letter of credit.

(b) If the offeror intends to use an ILC in lieu of a bid bond, or to secure other types of bonds such as performance and payment bonds, the letter of credit and letter of confirmation formats in paragraphs (e) and (f) of this clause shall be used.

(c) The letter of credit shall be irrevocable, shall require presentation of no document other than a written demand and the ILC (including confirming letter, if any), shall be issued/confirmed by an acceptable federally insured financial institution as provided in paragraph (d) of this clause, and -

(1) If used as a bid guarantee, the ILC shall expire no earlier than 60 days after the close of the bid acceptance period;

(2) If used as an alternative to corporate or individual sureties as security for a performance or payment bond, the offeror/Contractor may submit an ILC with an initial expiration date estimated to cover the entire period for which financial security is required or may submit an ILC with an initial expiration date that is a minimum period of one year from the date of issuance. The ILC shall provide that, unless the issuer provides the beneficiary written notice of non-renewal at least 60 days in advance of the current expiration date, the ILC is automatically extended without amendment for one year from the expiration date, or any future expiration date, until the period of required coverage is completed and the Contracting Officer provides the financial institution with a written statement waiving the right to payment. The period of required coverage shall be:

(i) For contracts subject to the Miller Act, the later of -

(A) One year following the expected date of final payment;

(B) For performance bonds only, until completion of any warranty period; or

(C) For payment bonds only, until resolution of all claims filed against the payment bond during the one-year period following final payment.

(ii) For contracts not subject to the Miller Act, the later of -

(A) 90 days following final payment; or

(B) For performance bonds only, until completion of any warranty period.

(d) Only federally insured financial institutions rated investment grade or higher shall issue or confirm the ILC. The offeror/Contractor shall provide the Contracting Officer a credit rating that indicates the financial institution has the required rating(s) as of the date of issuance of the ILC. Unless the financial institution issuing the ILC had letter of credit business of at least \$25 million in the past year, ILCs over \$5 million must be confirmed by another acceptable financial institution that had letter of credit business of at least \$25 million in the past year.

(e) The following format shall be used by the issuing financial institution to create an ILC:

[Issuing Financial Institution's Letterhead or Name and Address]

Issue Date _____

Irrevocable Letter of Credit No. _____

Account party's name _____

Account party's address _____

For Solicitation No. _____ (for reference only)

To: [U.S. Government agency]

[U.S. Government agency's address]

I. We hereby establish this irrevocable and transferable Letter of Credit in your favor for one or more drawings up to United States \$_____. This Letter of Credit is payable at [issuing financial institution's and, if any, confirming financial institution's] office at [issuing financial institution's address and, if any, confirming financial institution's address] and expires with our close of business on

_____, or any automatically extended expiration date.

2. We hereby undertake to honor your or the transferee's sight draft(s) drawn on the issuing or, if any, the confirming financial institution, for all or any part of this credit if presented with this Letter of Credit and confirmation, if any, at the office specified in paragraph 1 of this Letter of Credit on or before the expiration date or any automatically extended expiration date.

3. [This paragraph is omitted if used as a bid guarantee, and subsequent paragraphs are renumbered.] It is a condition of this Letter of Credit that it is deemed to be automatically extended without amendment for one year from the expiration date hereof, or any future expiration date, unless at least 60 days prior to any expiration date, we notify you or the transferee by registered mail, or other receipted means of delivery, that we elect not to consider this Letter of Credit renewed for any such additional period. At the time we notify you, we also agree to notify the account party (and confirming financial institution, if any) by the same means of delivery.

4. This Letter of Credit is transferable. Transfers and assignments of proceeds are to be effected without charge to either the beneficiary or the transferee/assignee of proceeds. Such transfer or assignment shall be only at the written direction of the Government (the beneficiary) in a form satisfactory to the issuing financial institution and the confirming financial institution, if any.

5. This Letter of Credit is subject to the Uniform Customs and Practice (UCP) for Documentary Credits, 1993 Revision, International Chamber of Commerce Publication No. 500, and to the extent not inconsistent therewith, to the laws of [state of confirming financial institution, if any, otherwise state of issuing financial institution] .

6. If this credit expires during an interruption of business of this financial institution as described in Article 17 of the UCP, the financial institution specifically agrees to effect payment if this credit is drawn against within 30 days after the resumption of our business.

Sincerely,

[Issuing financial institution]

(f) The following format shall be used by the financial institution to confirm an ILC:

[Confirming Financial Institution's Letterhead or Name and Address]

(Date) _____

Our Letter of Credit Advice Number _____

Beneficiary: [U.S. Government agency]

Issuing Financial Institution: _____

Issuing Financial Institution's LC No.: _____

Gentlemen:

1. We hereby confirm the above indicated Letter of Credit, the original of which is attached, issued by [name of issuing financial institution] for drawings of up to United States dollars _____/U.S.\$ _____ and expiring with our close of business on [the expiration date], or any automatically extended expiration date.

2. Draft(s) drawn under the Letter of Credit and this Confirmation are payable at our office located at _____.

3. We hereby undertake to honor sight draft(s) drawn under and presented with the Letter of Credit and this Confirmation at our offices as specified herein.

4. [This paragraph is omitted if used as a bid guarantee, and subsequent paragraphs are renumbered.] It is a condition of this confirmation that it be deemed automatically extended without amendment for one year from the expiration date hereof, or any automatically extended expiration date, unless:

(a) At least 60 days prior to any such expiration date, we shall notify the Contracting Officer, or the transferee and the issuing financial institution, by registered mail or other receipted means of delivery, that we elect not to consider this confirmation extended for any such additional period; or

(b) The issuing financial institution shall have exercised its right to notify you or the transferee, the account party, and ourselves, of its election not to extend the expiration date of the Letter of Credit.

5. This confirmation is subject to the Uniform Customs and Practice (UCP) for Documentary Credits, 1993 Revision, International Chamber of Commerce Publication No. 500, and to the extent not inconsistent therewith, to the laws of [state of confirming financial institution].

6. If this confirmation expires during an interruption of business of this financial institution as described in Article 17 of the UCP, we specifically agree to effect payment if this credit is drawn against within 30 days after the resumption of our business.

Sincerely,

[Confirming financial institution]

(g) The following format shall be used by the Contracting Officer for a sight draft to draw on the Letter of Credit:

SIGHT DRAFT

[City, State]

[Confirming financial institution]

(Date) _____

[Name and address of financial institution]

Pay to the order of [Beneficiary Agency] the sum of United States \$_____. This draft is drawn under Irrevocable Letter of Credit No. _____.

[Beneficiary Agency]

[Beneficiary Agency]

[By]

[By]

(End of clause)

Sec. I 52.252-1

52.252-1 SOLICITATION PROVISIONS INCORPORATED BY REFERENCE (FEB 1998)

This solicitation incorporates one or more solicitation provisions by reference, with the same force and effect as if they were given in full text. Upon request, the Contracting Officer will make their full text available. The offeror is cautioned that the listed provisions may include blocks that must be completed by the offeror and submitted with its quotation or offer. In lieu of submitting the full text of those provisions, the offeror may identify the provision by paragraph identifier and provide the appropriate information with its quotation or offer. Also, the full text of a solicitation provision may be accessed electronically at this/these address(es):

www.gsa.gov or www.arnet.gov

(End of provision)

AOC52.202-2

DEFINITIONS - CONSTRUCTION (JUN 2004)

(a) The term Government means the United States of America, represented by the Architect of the Capitol, who is the Contracting

Officer.

(b) The term head of the agency means the Committee, Commission, or other authority of the Legislative Branch of the Government having final jurisdiction or supervision over the work involved. The other authority as used in this paragraph includes the Architect of the Capitol in cases in which he has final jurisdiction or supervision over the work involved.

(c) The term Architect as used in the contract documents shall mean the Architect of the Capitol.

(d) The term Contracting Officer as used in the contract documents means the Architect of the Capitol or his duly authorized representative.

(e) The term his duly authorized representative means any person or persons or board authorized to act for the head of the agency within the scope of their authority.

(f) The term Contractor means the individual, partnership or corporation entering into a contract with the Government to perform the work specified.

(g) The term Subcontractor, as used in this part, means any supplier, distributor, vendor, or firm that furnishes supplies or services to or for a prime contractor or other subcontractor. There is no privity of contract between the Government and the Subcontractors.

(h) The term Project Director means the individual designated by the Architect to monitor the progress of work from a technical standpoint. The duties and responsibilities of the Project Director shall include supervision of scheduling, receipt and verification of Contractor's payrolls in accordance with the Davis Bacon Act, coordination between Divisions, concerning resolution and/or avoidance of potential problems and, to the extent authorized by the Delegation of Authority, if any, issuance of clarifications, supplemental agreements and change orders to the Contractor.

(i) The term contract documents includes, collectively, the Project Manual, the contract drawings and the addenda and modifications thereto, if any.

(j) The term work includes, but is not limited to, materials, labor, and manufacture and fabrication of components.

(k) The term specifications means the portion of the Contract Documents that consist of the written requirements for materials, equipment, construction systems, standards and workmanship for the Work, and performance of related services.

(l) The term drawings means the graphic and pictorial portions of the Contract Documents, wherever located and whenever issued, that show the design, location and dimensions of the Work, and generally includes plans, elevations, sections, details, schedules and diagrams.

(m) Wherever in the specifications or upon the drawings the word directed, required, ordered, designated, prescribed, or words of like import are used, it shall be understood that the direction, requirement, order, designation, or prescription, of the Contracting Officer is intended and similarly the words approved, acceptable, satisfactory, or words of like import shall mean approved by or acceptable to, or satisfactory to the Contracting Officer, unless otherwise expressly stated.

(n) Where as shown, as indicated, as detailed, or words of similar import are used, it shall be understood that the reference is made to the drawings accompanying this contract unless stated otherwise. The word provided as used herein shall be understood to mean provide complete in place, that is furnished and installed.

(End of clause)

AOC52.203-1

ADVERTISING/PROMOTIONAL MATERIALS (DEC 2005)

(a) It is the policy of the Congress to discourage contractors providing services and supplies to the Legislative Branch entities, including the Architect of the Capitol, from advertising practices that feature the Capitol and Capitol Complex in a manner in which conveys, or is reasonably calculated to convey, a false impression of sponsorship, approval or endorsement of any product or service by the Congress, the Government of the United States, or any Department, Agency or instrumentality thereof.

(b) Contractors performing construction services for Legislative Branch entities, including the Architect of the Capitol, are discouraged from capitalizing on their contractual relationships with such entities and shall not engage in advertising practices which convey, or are reasonably calculated to convey, a false impression of sponsorship, approval or endorsement of any product or service by the Congress, the Government of the United States, of any Department, Agency or instrumentality thereof. This includes utilizing, in conjunction with the fact of their contractual relationship, images of the Capitol, any other buildings in the Capitol Complex, or any part of the United States Capitol Grounds in their advertising or promotional materials; and/or publishing or disseminating the aforementioned advertising or promotional materials.

(c) The Contractor, by signing this contract, agrees to comply with the foregoing and to submit any proposed advertising or promotional copy connected in any manner with this contract and/or the Capitol, other Capitol Complex Buildings, or the United States Capitol Grounds to the Contracting Officer for approval prior to publication.

(d) If this solicitation is for supplies or services, including construction, to be provided to or performed for the United States Supreme Court, the Contractor, by signing this contract, agrees that he or she will not advertise the award of the contract in his/her commercial advertising in such a manner as to state or imply that the Supreme Court of the United States endorses a product, project, or commercial line of endeavor.

(End of clause)

AOC52.203-2

DISCLOSURE OF INFORMATION TO THE GENERAL PUBLIC (JUN 2004)

(a) Promptly after receiving any request from the general public for information on or data derived from this contract, the contractor shall notify the Architect of the Capitol, Procurement Division. The contractor shall cooperate with the Procurement Division in compiling or collecting information or data if the Architect of the Capitol determines the information or data to be releasable.

(b) General public, for purposes of this clause, are those groups or individuals who are not authorized by law or regulation to have access.

(c) This clause is not intended to prevent the contractor from providing contract information or data which the contractor is required to provide in order to conduct its business, such as insurance, banking, subcontracting.

(d) The contractor is permitted to request that proprietary information or data not be released if such release would harm or impair the contractor in conducting its normal business. Such request must be documented with clear and specific grounds for that claim.

(End of clause)

AOC52.204-1

PRINTED OR COPIED DOUBLE-SIDED ON RECYCLED PAPER (JUN 2004)

The Contractor is encouraged to submit paper documents, such as offers, letters, or reports, that are printed or copied doubled-sided on recycled paper and meet minimum content standards when not using electronic commerce methods to submit information or data to the Government.

(End of clause)

AOC52.211-3

DEFICIENCIES IN CONTRACT DOCUMENTS (JUN 2004)

The Contractor shall promptly inform the Contracting Officer, in writing, of any discovered errors, omissions, discrepancies, conflicts or ambiguities in the contract documents before proceeding with any work affected by such factors. Failure to do so will be at the risk of the Contractor.

(End of clause)

AOC52.211-6

NOTICE TO PROCEED (JUN 2004)

A formal notice, or notices, to proceed will be issued as soon as practical, normally after approval by the Contracting Officer of the bonds and insurance. Unless specifically authorized in writing, any steps taken in connection with the performance of, or the preparation to perform, the contract, prior to issuance of the notice to proceed, will be the responsibility of and at the risk of the Contractor, and without any cost whatsoever to the Government.

(End of clause)

AOC52.215-10

EXAMINATION OF RECORDS (JUN 2004)

(a) The Contractor agrees that the Architect of the Capitol or any duly authorized representatives shall, until the expiration of 3 years after final payment under this contract, have access to and the right to examine any books, accounting procedures and practices documents, papers, records and other data regardless of whether such items are in written form, in the form of computer data or in any other form and other supporting evidence, involving transactions related to this contract or compliance with any clause or certification thereunder.

(b) The Contractor further agrees to include in all its subcontracts hereunder a provision to the effect that subcontractor agrees that the Architect of the Capitol or any authorized representatives shall, until the expiration of 3 years after final payment under the subcontract, have access to and the right to examine books, documents, papers, records other data regardless of whether such items are in written form, in the form of computer data or in any other form, and other supporting evidence, involving transactions related to the subcontract or compliance with any clause or certification thereunder.

(c) The term subcontract as used in this clause excludes purchase orders not exceeding \$10,000.

(End of clause)

AOC52.215-11

AUDITS (JUN 2004)

(a) If the price of this contract is changed through the operation of any of the provisions of this contract, the Contractor, within such reasonable time as the Contracting Officer may direct, shall submit complete and accurate cost and pricing data in support of any claim asserted under such provisions.

(b) With the submission of cost and pricing data the Contractor shall supply the following certification by a duly authorized corporate officer, partner, or owner, as applicable:

"This is to certify that, to the best of my knowledge and belief, the cost and pricing data herewith submitted to the Contracting Officer in support of a price adjustment under Supplement/Claim No. for _____ (identify by description) are accurate and complete and they are current as of _____ (date).

Date of Execution _____

Firm _____

Signature _____

Title _____"

(c) The Contracting Officer in accordance with the FAR clause Audit and Records - Negotiation , 52.215-2, has the right to examine all books, records, documents and other data of the Contractor or subcontractor in order to evaluate the accuracy, completeness, and currency of cost or pricing data thus submitted. The Contractor shall insert an appropriate provision in all subcontracts for the purpose of making the requirements of this paragraph applicable thereto.

(End of clause)

AOC52.216-6

UNDEFINITIZED CONTRACT ACTIONS (MAR 2005)

(a) In the event of an urgent situation, the services or supplies may be required on an emergency basis under an undefinitized contract action (emergency task/delivery order, contract modification, or letter contract). The contract action may be either verbal, typed, or hand written, with the form of the undefinitized contract action dictated by the access the issuing Contracting Officer has to the AOC network or a computer. If issued verbally, the Contracting Officer shall provide a written confirming document to the location identified by the contractor within 5 calendar days after issuance of the verbal undefinitized contract action. If an undefinitized contract action is issued under an existing contract, the terms and conditions of the contract shall be in effect and incorporated by reference under any undefinitized contract issued.

(b) The scope of work as originally issued on the undefinitized contract action will, of necessity, be somewhat broad and general in nature. It is to also be considered as a Notice to Proceed immediately with the work under the undefinitized contract action. An estimated amount for the work to be performed shall be obligated to ensure that reasonable funds are available for payment to the contractor, and an estimated completion date shall be identified on the undefinitized contract action. If the contractor believes the amount of funds obligated or time for completion as stated in the undefinitized contract action are unreasonable, within 30 calendar days after issuance of the written undefinitized contract action the contractor is responsible for notifying the Contracting Officer of this and providing a suggested amount of funds for obligation or time for completion. In no instance shall the contractor's suggested amount of funds for obligation or time for completion be considered as binding to the contractor or the Government in future negotiations. The Government can elect to use the contractor's suggested amount of funds or time for completion as an indication that

some additional funds or time for completion may be required and obligated or adjusted, respectively, in order to ensure that reasonably adequate funds are available to pay the contractor for services performed or that the completion time is reasonable.

(c) Within a reasonable amount of time after the issuance of the undefinitized contract action but not later than an estimated 25% of the way through the completion of the work under the undefinitized contract action, an authorized representative of the contractor must meet, either in person or telephonically, with the Contracting Officer to further define the scope of work, negotiate the price, identify a final completion date, and address other activities necessary to definitize the undefinitized contract action. This estimated 25% shall use the best information reasonably available and be based upon (1) an estimate of the amount of work completed relative to the original general scope of work or (2) the amount of payments made relative to the original amount obligated.

(d) Payments can be made from the original amount obligated, but the undefinitized contract action must be definitized before payments exceed 40% of the funds originally obligated.

(e) If communications are disrupted to the degree that it is necessary to communicate with the Contracting Officer at their residence or through other devices that do not utilize AOC-owned equipment, i.e., the Contracting Officer's residential telephone line, home address, etc., the contractor shall treat the Contracting Officer's personal information as confidential and shall not divulge the information to any individual or organization, including but not limited to other AOC personnel, without the Contracting Officer's express written permission. If it becomes necessary for the Contracting Officer to communicate with the contractor through means other than the contractor's normal place of business, i.e., the contractor's residential telephone line or home address, the Contracting Officer shall not divulge the information to any individual or organization, including but not limited to other AOC or contractor personnel, without the contractor's express written permission.

(f) For the purposes of this clause, e-mail is considered express written permission.

(End of clause)

AOC52.219-1

UTILIZATION OF SMALL BUSINESS CONCERNS (AUG 2004)

(a) It is the policy of the Government as declared by the Congress that a fair proportion of the purchases and contracts for supplies and services for the Government be placed with all types of small business concerns as determined by the size standards in 13 CFR 121.

(b) The Contractor agrees to accomplish the maximum amount of subcontracting to all types of small business concerns that the Contractor finds to be consistent with the efficient performance of this contract.

(End of clause)

AOC52.222-1

OVERTIME WORK - CONSTRUCTION (AUG 2004)

No extra reimbursement will be allowed for work performed outside regular working hours or on Saturday, Sundays or holidays and, for work performed in the District of Columbia, Presidential Inauguration Day, unless such work is ordered in writing by the Contracting Officer and payment therefore is authorized in the written order, and provided such work is not otherwise required to be performed under terms of the contract.

(End of clause)

AOC52.222-3

CONVICT LABOR (JUN 2004)

In connection with the performance of work under this contract the Contractor agrees not to employ any person undergoing sentence of imprisonment except as provided by Public Law 89-176, approved September 10, 1965, 18 U.S.C. 4082(c)(2).

(End of clause)

AOC52.222-7

WORKMEN'S COMPENSATION LAWS (JUN 2004)

The Contractor and his subcontractors employed on the site shall comply with the Workmen's Compensation Laws of the District of Columbia.

(End of clause)

52.223-3

Hazardous Material Identification and Material Safety Data (Jan 1997)

(a) "Hazardous material," as used in this clause, includes any material defined as hazardous under the latest version of Federal Standard No. 313 (including revisions adopted during the term of the contract).

(b) The offeror must list any hazardous material, as defined in paragraph (a) of this clause, to be delivered under this contract. The hazardous material shall be properly identified and include any applicable identification number, such as National Stock Number or Special Item Number. This information shall also be included on the Material Safety Data Sheet submitted under this contract.

Material (If none, list None)	Identification No.

(c) This list must be updated during performance of the contract whenever the Contractor determines that any other material to be delivered under this contract is hazardous.

(d) The apparently successful offeror agrees to submit, for each item as required prior to award, a Material Safety Data Sheet, meeting the requirements of 29 CFR 1910.1200(g) and the latest version of Federal Standard No. 313, for all hazardous material identified in paragraph (b) of this clause. Data shall be submitted in accordance with Federal Standard No. 313, whether or not the apparently successful offeror is the actual manufacturer of these items. Failure to submit the Material Safety Data Sheet prior to award may result in the apparently successful offeror being considered nonresponsible and ineligible for award.

(e) If, after award, there is a change in the composition of the item(s) or a revision to Federal Standard No. 313, which renders incomplete or inaccurate the data submitted under paragraph (d) of this clause, the Contractor shall promptly notify the Contracting Officer and resubmit the data.

(f) Neither the requirements of this clause nor any act or failure to act by the Government shall relieve the Contractor of any responsibility or liability for the safety of Government, Contractor, or subcontractor personnel or property.

(g) Nothing contained in this clause shall relieve the Contractor from complying with applicable Federal, State, and local laws, codes, ordinances, and regulations (including the obtaining of licenses and permits) in connection with hazardous material.

(h) The Government's rights in data furnished under this contract with respect to hazardous material are as follows:

(1) To use, duplicate and disclose any data to which this clause is applicable. The purposes of this right are to--

(i) Apprise personnel of the hazards to which they may be exposed in using, handling, packaging, transporting, or disposing of hazardous materials;

(ii) Obtain medical treatment for those affected by the material; and

(iii) Have others use, duplicate, and disclose the data for the Government for these purposes.

(2) To use, duplicate, and disclose data furnished under this clause, in accordance with paragraph (h)(1) of this clause, in precedence over any other clause of this contract providing for rights in data.

(3) The Government is not precluded from using similar or identical data acquired from other sources.

(End of clause)

AOC52.223-1

HAZARDOUS MATERIAL IDENTIFICATION AND MATERIAL SAFETY DATA - SUPPLEMENT (JUN 2005)

(a) Except as provided in paragraph (c), the Contractor shall prepare and submit a sufficient number of Material Safety Data Sheets (MSDS s), meeting the requirements of 29 CFR 1910.1200(g) and the latest version of Federal Standard No. 313, for all hazardous materials identified in FAR 52.223-3(b).

(b) For items shipped to consignees, the Contractor shall include a copy of the MSDS s with the packing list or other suitable shipping document which accompanies each shipment. Alternatively, the Contractor is permitted to transmit MSDS s to consignees in advance of receipt of shipments by consignees, if authorized in writing by the Contracting Officer.

(c) For items shipped to consignees identified by mailing address as agency depots, distribution centers or customer supply centers, the Contractor shall provide one copy of the MSDS in or on each shipping container. If affixed to the outside of each container, the MSDS s must be placed in a weather resistant envelope.

(d) For items provided to a construction site, the contractor shall provide two copies of each MSDS. One copy shall be provided to the COTR in accordance with the Division 1 submittal requirements, and a second copy shall be kept in an MSDS binder on the job site.

(End of clause)

AOC52.223-3

SECURITY MARKINGS (JUN 2004)

(a) Before dissemination to subcontractors or other personnel, all AOC drawings and electronic copies thereof shall be considered at a minimum to be sensitive but unclassified (SBU). The following statement shall be imprinted on each page of drawings:

PROPERTY OF THE UNITED STATES GOVERNMENT
COPYING, DISSEMINATING, OR DISTRIBUTING THESE DRAWINGS, PLANS OR SPECIFICATIONS TO
UNAUTHORIZED USERS IS PROHIBITED

Do not remove this notice

Properly destroy documents when no longer needed

(b) The following paragraph shall be included on the cover page of the information (such as the cover page on a set of construction drawings and on the cover page of the specifications).

PROPERTY OF THE UNITED STATES GOVERNMENT
COPYING, DISSEMINATING, OR DISTRIBUTING THESE DRAWINGS, PLANS OR SPECIFICATIONS TO
UNAUTHORIZED USERS IS PROHIBITED

Do not remove this notice

Properly destroy documents when no longer needed

(End of clause)

AOC52.223-4

TRANSMISSION OR POSTING OF DRAWINGS/SPECIFICATIONS (JUN 2004)

Due to security issues, the contractor is strictly prohibited from placing or transmitting drawings and specifications on the internet or modem without express permission from the Architect of the Capitol.

(End of clause)

52.225-9

Buy American Act--Construction Materials (Jan 2005)

(a) *Definitions.* As used in this clause--

"Component" means an article, material, or supply incorporated directly into a construction material.

"Construction material" means an article, material, or supply brought to the construction site by the Contractor or a subcontractor for incorporation into the building or work. The term also includes an item brought to the site preassembled from articles, materials, or supplies. However, emergency life safety systems, such as emergency lighting, fire alarm, and audio evacuation systems, that are discrete systems incorporated into a public building or work and that are produced as complete systems, are evaluated as a single and distinct construction material regardless of when or how the individual parts or components of those systems are delivered to the construction site. Materials purchased directly by the Government are supplies, not construction material.

"Cost of components" means--

(1) For components purchased by the Contractor, the acquisition cost, including transportation costs to the place of incorporation into

the construction material (whether or not such costs are paid to a domestic firm), and any applicable duty (whether or not a duty-free entry certificate is issued); or

(2) For components manufactured by the Contractor, all costs associated with the manufacture of the component, including transportation costs as described in paragraph (1) of this definition, plus allocable overhead costs, but excluding profit. Cost of components does not include any costs associated with the manufacture of the construction material.

"Domestic construction material" means--

(1) An unmanufactured construction material mined or produced in the United States; or

(2) A construction material manufactured in the United States, if the cost of its components mined, produced, or manufactured in the United States exceeds 50 percent of the cost of all its components. Components of foreign origin of the same class or kind for which nonavailability determinations have been made are treated as domestic.

"Foreign construction material" means a construction material other than a domestic construction material.

"United States" means the 50 States, the District of Columbia, and outlying areas.

(b) *Domestic preference.*

(1) This clause implements the Buy American Act (41 U.S.C. 10a - 10d) by providing a preference for domestic construction material. The Contractor shall use only domestic construction material in performing this contract, except as provided in paragraphs (b)(2) and (b)(3) of this clause.

(2) This requirement does not apply to the construction material or components listed by the Government as follows:

none

(3) The Contracting Officer may add other foreign construction material to the list in paragraph (b)(2) of this clause if the Government determines that--

(i) The cost of domestic construction material would be unreasonable. The cost of a particular domestic construction material subject to the requirements of the Buy American Act is unreasonable when the cost of such material exceeds the cost of foreign material by more than 6 percent;

(ii) The application of the restriction of the Buy American Act to a particular construction material would be impracticable or inconsistent with the public interest; or

(iii) The construction material is not mined, produced, or manufactured in the United States in sufficient and reasonably available commercial quantities of a satisfactory quality.

(c) *Request for determination of inapplicability of the Buy American Act.*

(1)(i) Any Contractor request to use foreign construction material in accordance with paragraph (b)(3) of this clause shall include adequate information for Government evaluation of the request, including--

(A) A description of the foreign and domestic construction materials;

(B) Unit of measure;

(C) Quantity;

(D) Price;

(E) Time of delivery or availability;

(F) Location of the construction project;

(G) Name and address of the proposed supplier; and

(H) A detailed justification of the reason for use of foreign construction materials cited in accordance with paragraph (b)(3) of this clause.

(ii) A request based on unreasonable cost shall include a reasonable survey of the market and a completed price comparison table in

the format in paragraph (d) of this clause.

(iii) The price of construction material shall include all delivery costs to the construction site and any applicable duty (whether or not a duty-free certificate may be issued).

(iv) Any Contractor request for a determination submitted after contract award shall explain why the Contractor could not reasonably foresee the need for such determination and could not have requested the determination before contract award. If the Contractor does not submit a satisfactory explanation, the Contracting Officer need not make a determination.

(2) If the Government determines after contract award that an exception to the Buy American Act applies and the Contracting Officer and the Contractor negotiate adequate consideration, the Contracting Officer will modify the contract to allow use of the foreign construction material. However, when the basis for the exception is the unreasonable price of a domestic construction material, adequate consideration is not less than the differential established in paragraph (b)(3)(i) of this clause.

(3) Unless the Government determines that an exception to the Buy American Act applies, use of foreign construction material is noncompliant with the Buy American Act.

(d) *Data.* To permit evaluation of requests under paragraph (c) of this clause based on unreasonable cost, the Contractor shall include the following information and any applicable supporting data based on the survey of suppliers:

FOREIGN AND DOMESTIC CONSTRUCTION MATERIALS PRICE COMPARISON

Construction Material Description	Unit of Measure	Quantity	Price (Dollars)*
Item 1:	--	--	--
Foreign Construction Material			
Domestic Construction Material			
Item 2:	--	--	--
Foreign Construction Material			
Domestic Construction Material			

[List name, address, telephone number, and contact for suppliers surveyed. Attach copy of response; if oral, attach summary.]

[Include other applicable supporting information.]

[Include all delivery costs to the construction site and any applicable duty (whether or not a duty-free entry certificate is issued).]*

(End of clause)

AOC52.225-1

BUY AMERICAN ACT - SUPPLEMENT (JUN 2004)

In addition to provisions of the above clause entitled, Buy American Act, the General Provisions of the Legislative Branch Appropriations Act provides in part, as follows:

(a) It is the sense of the Congress that, to the greatest extent practicable, all equipment and products purchased with funds made available in the Act should be American-made.

(b) In providing financial assistance to or entering into any contract with, any entity using funds made available in the Act, the head of each Federal Agency, to the greatest extent practicable, shall provide to such entity a notice describing the statement made in Paragraph (a) above, by the Congress.

(End of clause)

AOC52.228-2

INSURANCE - WORK ON A GOVERNMENT INSTALLATION (JUL 2005)

(a) The Contractor shall, at his own expense, provide and maintain during the entire performance of this contract at least the kinds and minimum amounts of insurance as required in this clause.

(b) Within twenty (20) calendar days after the date of contract award or before commencing work under this contract, whichever is earlier, the Contractor shall notify the Contracting Officer in writing that the required insurance has been obtained. A Certificate of Insurance evidencing the Contractor's compliance with the requirements of this clause, identifying all policies of insurance and sureties proposed for the provision of liability coverage pertinent to the work of the instant contract, including the endorsement

required in this paragraph, and manually countersigned by an authorized representative of the insurance company shall be submitted in accordance with the time frame stated in this paragraph. All policies for liability protection, bodily injury, or property damage shall include the United States of America, acting by and through the Architect of the Capitol, as an additional insured with respect to operations under this contract. Each policy of insurance shall contain the following endorsement, which may be attached as a rider:

"It is understood and agreed that the Contractor's Insurance Company or surety shall notify the Architect of the Capitol, in writing, thirty (30) calendar days in advance of the effective date of any reduction in or cancellation of this policy."

(c) Insurance and required minimum liability limits are:

(1) Appropriate bodily injury and property damage liability insurance, with limits of not less than \$500,000 for each occurrence and \$2,000,000 for annual aggregate, including requirements for protection of hoisting and scaffolding operations, when applicable, and servicing areas adjacent to the building;

(2) Automobile bodily injury liability insurance with limits of not less than \$200,000 for each person and \$500,000 for each accident, and property liability insurance, with a limit of not less than \$20,000 for each accident. A combined single limit for these coverages is acceptable; and/or

(3) Workmen's compensation insurance as required by the laws of (1) the District of Columbia for work performed on a Government site located in the District of Columbia; (2) the State of Maryland for work performed on a Government site located in Maryland; or (3) the Commonwealth of Virginia for work performed on a Government site located in Virginia.

(d) The Contractor shall insert the substance of this clause, including this paragraph, in subcontracts under this contract that require work on a Government installation, and shall require subcontractors to provide and maintain the insurance required in this clause. The Contractor shall maintain a copy of all subcontractors proofs of required insurance, and shall make copies available to the Contracting Officer upon request.

(End of clause)

AOC52.228-5

AOC52.228-5 PAYMENT PROTECTION AND PERFORMANCE BONDS - CONSTRUCTION (DEC 2006)

(a) Payment protection and performance bonds. (1) For a new definitive contract (one containing no provisions for issuance of task orders) or purchase order, payment protection and performance bonds, if required, shall be provided by the contractor after notice of award of the contract.

(2) For indefinite-delivery contractS, the contractor has the option of providing --

(i) Payment protection and performance bonds for the total estimated amount of the contract within the time frame as specified elsewhere in the contract; or

(ii) Payment protection and performance bonds upon the issuance of each task order under the contract and as determined by the value of the instant task order within the time frame as specified elsewhere for the instant task order.

(b) Required bonds. (1) A performance bond is not required if the original contract, purchase order, or task order amount is \$100,000 or less.

(2) A performance bond (Standard Form 25) is required if the original contract, purchase order, or task order amount exceeds \$100,000. The penal amount of performance bonds at the time of contract award shall be 100 percent of the original contract, purchase order, or task order amount.

(3) Payment protection is not required if the original contract, purchase order, or task order amount is \$30,000 or less.

(4) Payment protection is required if the original contract, purchase order, or task order is greater than \$30,000. The penal amount of payment protection at the time of award shall be 100 percent of the original contract, purchase order, or task order amount. See FAR 52.228-13, Alternative Payment Protections, for the types of acceptable payment protection.

(c) Irrevocable letter of credit. If an irrevocable letter of credit is used, FAR 52.228-14, Irrevocable Letter of Credit, is applicable and can be found at <http://www.arnet.gov/far/index.html>.

(d) Additional bond protection. (1) The Government may require additional performance and payment bond protection if the contract price is increased. The increase in protection generally will equal 100 percent of the increase in contract price.

(2) The Government may secure the additional protection by directing the Contractor to increase the penal amount of the existing

bonds or to obtain an additional bond.

(e) Furnishing executed bonds. The Contractor shall furnish all executed bonds, including any necessary reinsurance agreements, to the Contracting Officer, within the time period specified elsewhere in the contract or order or prior to commencing work, whichever is sooner.

(f) Surety or other security for bonds. The bonds shall be in the form of firm commitment, supported by corporate sureties whose names appear on the list contained in Treasury Department Circular 570, or by other acceptable security such as postal money order, certified check, cashier's check, irrevocable letter of credit, or, in accordance with Treasury Department regulations, certain bonds or notes of the United States. Treasury Circular 570 is published in the Federal Register or may be obtained from the U.S. Department of Treasury, Financial Management Service, Surety Bond Branch, 3700 East West Highway Room 6F01, Hyattsville MD 20782 or via the internet at <http://www.fms.treas.gov/c570>.

(g) Notice of subcontractor waiver of protection (40 U.S.C. 270 b(c)). Any waiver of the right to sue on the payment bond is void unless it is in writing, signed by the person whose right is waived, and executed after such person has first furnished labor or material for use in the performance of the contract.

(h) Upon the request of a prospective subcontractor or supplier offering to furnish labor or material for the performance of this contract for which a payment bond has been furnished to the Government pursuant to the Miller Act, the Contractor shall promptly provide a copy of such payment bond to the requester.

(End of clause)

AOC52.228-6

NOTICE TO SURETIES (JUN 2004)

The final inspection and acceptance of the work included in this contract shall not be binding or conclusive upon the Government if it shall subsequently appear that the Contractor has willfully or fraudulently, or through collusion with the representatives of the Government in charge of the work, supplied inferior material or workmanship, or has departed from the terms of the contract, or if defects of any kind should develop during the period that the guarantees covering such material and workmanship are in force. In such event, the Government shall have the right, notwithstanding such final acceptance and payment, to have the work removed and to cause the work to be properly performed and satisfactory material supplied to such extent as, in the opinion of the Contracting Officer, may be necessary to finish the work in accordance with the drawings, if any, and specifications, at the expense of the Contractor and the sureties on its bond, and the Government shall have the right to recover against the Contractor and its sureties the cost of such work, together with such other damages as the Government may suffer because of the default of the Contractor in the premises, the same as though such acceptance and final payment had not been made.

(End of clause)

AOC52.232-6

PAYMENT BY ELECTRONIC FUNDS TRANSFER - OTHER THAN CENTRAL CONTRACTOR REGISTRATION (JUN 2004)

(a) Method of payment.

(1) All payments by the Government under this contract shall be made by electronic funds transfer (EFT) except as provided in paragraph (a)(2) of this clause. As used in this clause, the term "EFT" refers to the funds transfer.

(2) In the event the Government is unable to release one or more payments by EFT, the contractor agrees to either

(i) Accept payment by check or some other mutually agreeable method of payment; or

(ii) Request the Government to delay payment until such time as the Government makes payment by EFT (but see paragraph (d)).

(b) Mandatory submission of Contractor's EFT information. (1) The Contractor is required to provide the Government with the information required to make payment by EFT (see paragraph (i) of this clause). The contractor shall provide this information directly to the office designated in paragraph (k) to receive that information (hereafter: "designated office") by three working days after notification of contract award. If not otherwise specified in this contract, the payment office is the designated office for receipt of the contractor's EFT information. If more than one designated office is named for the contract, the contractor shall provide a separate notice to each office. In the event that the EFT information changes, the contractor shall be responsible for providing the updated information to the designated office(s).

(2) If the contractor provides EFT information applicable to multiple contracts, the contractor shall specifically state the applicability

of this EFT information in terms acceptable to the designated office. However, EFT information supplied to a designated office shall be applicable only to contracts that identify that designated office as the office to receive EFT information for that contract.

(c) Mechanisms for EFT payment. The Government may make payment by EFT through the Automated Clearing House (ACH) network, subject to the rules of the National Automated Clearing House Association. The rules governing Federal payments through the ACH are contained in 31 CFR part 210.

(d) Suspension of payment.

(1) Notwithstanding the provisions of any other clause of this contract, the Government is not required to make any payment under this contract until after receipt, by the designated payment office, of the correct EFT payment information from the Contractor. Until receipt of the correct EFT information, any invoice or contract financing request shall be deemed not to be a valid invoice.

(2) If the EFT information changes after submission of correct EFT information, the Government shall begin using the changed EFT information no later than the 30 days after its receipt by the designated office to the extent payment is made by EFT. However, the Contractor may request that no further payments be made until the changed EFT information is implemented by the payment office.

(e) Liability for uncompleted or erroneous transfers. (1) If an uncompleted or erroneous transfer occurs because the Government failed to use the Contractor provided EFT information in the correct manner, the Government remains responsible for--

(i) Making a correct payment; and

(ii) Recovering any erroneously directed funds.

(2) If an uncompleted or erroneous transfer occurs because Contractor's EFT information was incorrect at the time of Government release or was revised within 30 days of Government release of the EFT payment transaction instruction to the Federal Reserve System, and

(i) If the funds are no longer under the control of the payment office, the Government is deemed to have made payment and the Contractor is responsible for recovery of any erroneously directed funds; or

(ii) If the funds remain under the control of the payment office, the Government shall not make payment and the provisions of paragraph (d) shall apply.

(f) EFT and assignment of claims. If the contractor assigns the proceeds of this contract as provided for in the assignment of claims terms of this contract, the contractor shall require as a condition of any such assignment that the assignee shall provide the EFT information required by paragraph (i) of this clause to the designated office and shall be paid by EFT in accordance with the terms of this clause. In all respects, the requirements of this clause shall apply to the assignee as if it were the contractor. EFT information that shows the ultimate recipient of the transfer to be other than the contractor, in the absence of a proper assignment of claims acceptable to the Government, is incorrect EFT information within the meaning of Paragraph (d) of this clause.

(g) Liability for change of EFT information by financial agent. The Government is not liable for errors resulting from changes to EFT information provided by the contractor's financial agent.

(h) Payment information. The payment or disbursing office shall forward to the Contractor available payment information that is suitable for transmission as of the date of release of the EFT instruction to the Federal Reserve System. The Government may request the Contractor to designate a desired format and method(s) for delivery of payment information from a list of formats and methods the payment office is capable of executing. However, the Government does not guarantee that any particular format or method of delivery is available at any particular payment office and retains the latitude to use the format and delivery method most convenient to the Government. If the Government makes payment by check in accordance with paragraph (a) of this clause, the Government shall mail the payment information to the remittance address in the contract.

(i) EFT Information. The contractor shall provide the following information to the designated payment office. The contractor may supply this data for this or multiple contracts (see paragraph (b) of this clause). The Contractor shall designate a single financial agent per contract capable of receiving and processing the EFT information using the EFT methods described in paragraph (c) of this clause. The information required is as follows:

(1) The contract number;

(2) The contractor's name and remittance address as stated in the contract(s);

(3) The signature (manual or electronic, as appropriate), title, and telephone number of the contractor's official authorized to provide this information;

(4) The name, address, and 9 digit Routing Transit Number of the contractor s financial agent; and

(5) The contractor s account number and the type of account (checking, saving or lockbox).

(j) The Contractor shall send all EFT information, and any changes to EFT information to the office designated in paragraph (k) of this clause. The Contractor shall not send EFT information to the payment office, or any other office than that designated in paragraph (k). The Government need not use any EFT information sent to any office other than that designated in paragraph (k).

(k) Designated office:

Name:

Architect of the Capital

Accounting Division

Mailing Address:

2nd and D Streets SW

Ford House Office Building

Washington, DC 20515

Telephone:

(202) 226-2552

Facsimile:

(202) 225-7321

(End of clause)

AOC52.232-9

PAYMENT OF INTEREST ON CONTRACTOR CLAIMS (JUN 2004)

(a) If an appeal is filed by the Contractor from a final decision of the Contracting Officer under the Disputes paragraph of this contract, denying a claim arising under the contract, simple interest on the amount of the claim finally determined owed by the Government shall be payable to the Contractor. Such interest shall be at the rate determined by the Secretary of the Treasury pursuant to Public Law 92 41, 85 Stat. 97, from the date the Contractor furnishes to the Contracting Officer his written appeal under the Disputes paragraph of this contract, to the date of (1) a final judgement by a court of competent jurisdiction, or (2) mailing to the Contractor of a change order, or a supplemental agreement for execution either confirming completed negotiations between the parties or carrying out a decision of a contract appeals board.

(b) Notwithstanding Paragraph (a) above, (1) interest shall be applied only from the date payment was due, if such date is later than the filing of appeal, and (2) interest shall not be paid for any period of time that the Contracting Officer determines the Contractor has unduly delayed in pursuing his remedies before a board of contract appeals or a court of competent jurisdiction.

(End of clause)

AOC52.232-12

ASSIGNMENT - SUPPLEMENT (SEP 2004)

Neither the contract nor any interest therein shall be assigned. However, moneys due or to become due under the contract may be assigned in accordance with the provisions of FAR clause 52.232-23 (ASSIGNMENT OF CLAIMS) as incorporated by reference in Section I.

(End of clause)

AOC52.233-1

DISPUTES (JUN 2004)

(a) Except as otherwise provided in this contract, any dispute concerning a question of fact arising under this contract which is not disposed of by agreement shall be decided by the Contracting Officer, who shall reduce his decision to writing and mail or otherwise furnish a copy thereof to the Contractor. The decision of the Contracting Officer shall be final and conclusive unless, within 30 days from the date of receipt of such copy, the Contractor mails or otherwise furnishes to the Contracting Officer a written appeal addressed to the head of the agency involved. The decision of the head of the agency or his duly authorized representative for the determination of such appeals shall be final and conclusive. This provision shall not be pleaded in any suit involving a question of fact arising under this contract as limiting judicial review of any such decision to cases where fraud by such official or his representative or board is alleged; provided, however, that any such decision shall be final and conclusive unless the same is fraudulent or capricious or arbitrary

or so grossly erroneous as necessarily to imply bad faith or is not supported by substantial evidence. In connection with any appeal proceeding under this paragraph, the Contractor shall be afforded an opportunity to be heard and to offer evidence in support of his appeal. Pending final decision of a dispute hereunder, the Contractor shall proceed diligently with the performance of the contract and in accordance with the Contracting Officer's decision.

(b) This paragraph does not preclude consideration of questions of law in connection with decisions provided for in Paragraph (a) above. Nothing in this contract, however, shall be construed as making final the decision of any administrative official, representative, or board on a question of law.

(End of clause)

AOC52.233-2

CLAIMS FOR EQUITABLE ADJUSTMENTS - WAIVER AND RELEASE OF CLAIMS (JUN 2004)

(a) Whenever the Contractor submits a claim for equitable adjustment under any paragraph of this contract which provides for equitable adjustment of the contract, such claim shall include all types of adjustments in the total amounts to which the paragraph entitles the Contractor, including but not limited to adjustments arising out of delays or disruptions or both caused by such change. Except as the parties may otherwise expressly agree, the Contractor shall be deemed to have waived (1) any adjustments to which it otherwise might be entitled under the paragraph where such claims fail to request such adjustments, and (2) any increase in the amount of equitable adjustments additional to those requested in its claim.

(b) Further, the Contractor agrees that, if required by the Contracting Officer, he will execute a release, in form and substance satisfactory to the Contracting Officer, as part of the supplemental agreement setting forth the aforesaid equitable adjustment, and that such release shall discharge the Government, its officers, agents and employees, from any further claims, including but not limited to further claims arising out of delays or disruptions or both, caused by the aforesaid change.

(End of clause)

AOC52.233-3

LIMITATIONS ON DAMAGES FOR DELAY (JUN 2004)

(a) The Architect shall not be obligated or liable to the Contractor for, and the Contractor hereby expressly waives any claims against the Architect on account of any damages, of any nature whatsoever, which the Contractor, or its subcontractor at any tier may incur as a result of delays, interferences, disruptions, suspensions, changes in sequence or the like arising from or out of any act or omission of the Architect, it being understood and agreed that the Contractor's sole and exclusive remedies in such event shall be a reimbursement of direct costs necessarily incurred as a result of the foregoing causes, and an extension of the contract time, but only in accordance with the provisions of the Contract Documents.

(b) For the purposes of this clause, the term "Damages" shall include all indirect and/or impact costs which shall include, without limitation: unabsorbed Home Office Overhead (including calculations under the "Eichleay Formula"), Idle Labor and Equipment, Loss of Productivity, and Interest; the term "Damages" shall not include on-site direct costs, which shall include direct labor (superintendence, labor, time-keeping, and clerical work) direct materials and supplies (including material handling), direct equipment, restoration and cleanup, overhead and profit (but only as permitted under the clauses Changes and Changes - Supplement, taxes, insurance, and bonding costs, which will be calculated in accordance with the clauses Changes and Changes - Supplement. Provided, however, that the accounting practice of treating these costs as "direct" shall be in accordance with

(1) The Contractor's established and consistently followed cost accounting practices for all work; and

(2) FAR Cost Accounting Cost Principles and Procedures (FAR Part 31).

(c) To the extent that any other provision of this contract provides for the payment of damages, as defined in this clause, to the Contractor and is thus inconsistent with the provisions of this clause, such other provision will be superseded hereby with respect to the issue of damages.

(End of clause)

52.236-5

Material and Workmanship (Apr 1984)

(a) All equipment, material, and articles incorporated into the work covered by this contract shall be new and of the most suitable grade for the purpose intended, unless otherwise specifically provided in this contract. References in the specifications to equipment, material, articles, or patented processes by trade name, make, or catalog number, shall be regarded as establishing a standard of quality

and shall not be construed as limiting competition. The Contractor may, at its option, use any equipment, material, article, or process that, in the judgment of the Contracting Officer, is equal to that named in the specifications, unless otherwise specifically provided in this contract.

(b) The Contractor shall obtain the Contracting Officer's approval of the machinery and mechanical and other equipment to be incorporated into the work. When requesting approval, the Contractor shall furnish to the Contracting Officer the name of the manufacturer, the model number, and other information concerning the performance, capacity, nature, and rating of the machinery and mechanical and other equipment. When required by this contract or by the Contracting Officer, the Contractor shall also obtain the Contracting Officer's approval of the material or articles which the Contractor contemplates incorporating into the work. When requesting approval, the Contractor shall provide full information concerning the material or articles. When directed to do so, the Contractor shall submit samples for approval at the Contractor's expense, with all shipping charges prepaid. Machinery, equipment, material, and articles that do not have the required approval shall be installed or used at the risk of subsequent rejection.

(c) All work under this contract shall be performed in a skillful and workmanlike manner. The Contracting Officer may require, in writing, that the Contractor remove from the work any employee the Contracting Officer deems incompetent, careless, or otherwise objectionable.

(End of clause)

52.236-9

Protection of Existing Vegetation, Structures, Equipment, Utilities, and Improvements (Apr 1984)

(a) The Contractor shall preserve and protect all structures, equipment, and vegetation (such as trees, shrubs, and grass) on or adjacent to the work site, which are not to be removed and which do not unreasonably interfere with the work required under this contract. The Contractor shall only remove trees when specifically authorized to do so, and shall avoid damaging vegetation that will remain in place. If any limbs or branches of trees are broken during contract performance, or by the careless operation of equipment, or by workmen, the Contractor shall trim those limbs or branches with a clean cut and paint the cut with a tree-pruning compound as directed by the Contracting Officer.

(b) The Contractor shall protect from damage all existing improvements and utilities (1) at or near the work site, and (2) on adjacent property of a third party, the locations of which are made known to or should be known by the Contractor. The Contractor shall repair any damage to those facilities, including those that are the property of a third party, resulting from failure to comply with the requirements of this contract or failure to exercise reasonable care in performing the work. If the Contractor fails or refuses to repair the damage promptly, the Contracting Officer may have the necessary work performed and charge the cost to the Contractor.

(End of clause)

AOC52.236-1

ACCESS TO WORK (JUN 2004)

(a) The Contracting Officer or his representative may visit and inspect the Contractor's plant, without advance notice, at any time during the course of this contract, and he shall be granted every available assistance to facilitate such inspection.

(b) The Contracting Officer and proper members of his staff shall at all times have access to the work, and the Contractor shall provide proper and safe facilities for such access and for inspection.

(End of clause)

AOC52.236-2

OTHER CONTRACTS AND WORK (JUN 2004)

(a) The Contractor shall fully inform himself as to conditions relating to construction and labor under which other work, if any, is being performed, or is to be performed, by or for the Government, by contract or otherwise, where such work may affect or be affected by, operations under this Contract.

(b) Notwithstanding the performance by other parties of work at the site during performance of this contract, the Contractor shall prosecute the work diligently and continuously, and he shall cooperate in every way with such other parties. The Contractor shall give such other parties, to the extent their work is affected by his work, all information necessary for the proper execution of their work, without delay. The Contractor shall so arrange and conduct his work that other parties may complete their work at the site according to schedule. All other work under the instant contract shall be carefully coordinated with work under such other contracts.

(End of clause)

AOC52.236-3

ACCIDENT PREVENTION AND SAFETY AND HEALTH PROGRAMS - CONSTRUCTION (SEP 2004)

(a) The Contractor shall take proper safety and health precautions to protect the work, the workers, the public, and the property of others and comply with the safety and health standards published in 41 C.F.R. Part 50-205, including any matters incorporated by reference therein. He shall also be responsible for all materials delivered and work performed until completion and final acceptance of the entire contract work, except for any completed unit thereof which theretofore may have been finally accepted.

(b) Williams-Steiger Occupational Safety and Health Act. The Contractor shall also comply in all aspects of the job with the regulations issued by the Secretary of Labor pursuant to the Williams-Steiger Occupational Safety and Health Act of 1970, as set forth in Title 29 of the Code of Federal Regulations. The Contractor shall bring to the attention of the Architect any work encountered which may involve entry into a suspected confined space as defined by OSHA. A determination will be made by the Architect, and if the area is deemed a permit required confined space, additional protective measures will be needed, per OSHA requirements.

(c) National Fire Protection Association standards. The Contractor shall comply with all applicable standards of the National Fire Protection Association relative to fire prevention, except to the extent that more exacting requirements are specified or imposed by the Contracting Officer. The Contractor shall keep and properly maintain fire prevention devices at the job site and shall take all possible precautions deemed necessary by the Government representative in charge of the work.

(d) Protection of property and persons. (1) The Contractor shall protect all of his material and work at the site, whether incorporated in the work or not, against damage or loss from any cause, and he shall take all necessary precautions against damage to all other work and material on the site. He shall provide and maintain necessary safeguards for protection of his employees, Government employees and the public generally, and he shall take all other proper precautions for their protection against injury. He shall comply with all directives and regulations of the Contracting Officer and other proper authorities relative to the use of public property.

(2) The Contractor shall protect all electric, telephone, computer facilities, water, gas, sewer, steam and other underground utility lines, in sidewalks, streets or other areas in, under or around the site, to the satisfaction of the Contracting Officer, the Government of the District of Columbia, and all other authorities having jurisdiction.

(3) The performance of work at the site by other parties shall not relieve the Contractor from any liability for loss or damage or from his obligations under this contract. No agreement or arrangement between the Contractor and others as to a division or proportionate share of liability for loss or damage incurred, or of the cost of insurance, shall in any way relieve the Contractor of such liability or his obligations under this contract.

(e) The Contractor shall comply with the requirements of FAR 52.236.13, Accident Prevention. In the event that conditions on the site pose an imminent danger or threat to the Contractor's workers, the public, Government employees, other persons, or to Capitol complex structures and property of historical significance, the Contracting Officer can verbally order the Contractor to suspend work operations in the specified area until said conditions are corrected to the Contracting Officer's satisfaction. The Contracting Officer shall promptly issue a written order to suspend the work to the Contractor formalizing the specifics of the verbal suspension of work.

(f) The Contractor shall not be entitled to any equitable adjustment of the contract price or extension of the performance schedule on any stop work order issued under this clause.

(End of clause)

AOC52.236-4

CUTTING AND PATCHING (JUN 2004)

Prior to initiation of the work operations of either cutting or patching, as a necessary requirement of the work under this contract, of any structural component or of lintels, stair systems, piping, duct work, vessels, equipment and like items in the building, the Contractor shall consult with the Contracting Officer and follow explicitly his directions and stated requirements concerning methods, materials, the manner in which the work is performed, and the level of competence and skill possessed by Contractor's employees, or those of subcontractors, who are proposed to be employed in said cutting and/or patching operations.

(End of clause)

AOC52.236-5

CLEANING AND RESTORING (JUN 2004)

(a) The contractor shall remove dirt and debris resulting from the operations under this contract daily.

(b) The Contractor shall, as a condition precedent to the final acceptance of the work, remove from the site of the work all remaining plant, installations, temporary barricades, temporary facilities, equipment, tools, materials, refuse, rubbish and waste, used or accumulated in connection with, but not incorporated in, the work, unless otherwise specified or directed, and he shall leave the buildings, grounds, streets, and all public places occupied by him in a thoroughly clean, neat and satisfactory condition.

(End of clause)

AOC52.236-8

SCHEDULING OF WORK (AUG 2004)

(a) The Contractor shall, before commencing work on the contract or another period of time determined by the Contracting Officer, prepare and submit to the Contracting Officer for approval three copies of a practicable schedule showing the order in which the Contractor proposes to perform the work, and the dates on which the Contractor contemplates starting and completing the several salient features of the work (including acquiring materials, plant, and equipment). The schedule shall be in the form of a progress chart of suitable scale to indicate appropriately the percentage of work scheduled for completion by any given date during the period. If the Contractor fails to submit a schedule within the time prescribed, the Contracting Officer may withhold approval of partial payments until the Contractor submits the required schedule.

(b) The Contractor shall furnish sufficient forces, construction plant and equipment, and shall work such hours as necessary to insure prosecution of work in accordance with the approved schedule. If, in the opinion of the Contracting Officer, the Contractor falls behind in the scheduled progress, the Contractor shall take such steps as may be necessary to improve its progress, including those that may be required by the Contracting Officer, without additional cost to the Government. In this circumstance, the Contracting Officer may require the Contractor to increase the number of shifts, overtime operations, days of work, and/or the amount of construction plant, and to submit for approval any supplementary schedule or schedules in chart form as the Contracting Officer deems necessary to demonstrate how the approved rate of progress will be regained. The provisions of this subparagraph shall not be construed as prohibiting work on Saturdays, Sundays and holidays and, for work performed in the District of Columbia, Presidential Inauguration Day, if the Contractor so elects and if approved.

(c) Failure of the Contractor to comply with the requirements of the Contracting Officer under this clause shall be grounds for a determination by the Contracting Officer that the Contractor is not prosecuting the work with sufficient diligence to ensure completion within the time specified in the contract. Upon making this determination, the Contracting Officer may terminate the Contractor's right to proceed with the work, or any separable part of it, in accordance with the default terms of this contract.

(End of clause)

AOC52.236-9

AOC52.236-9 SCHEDULE OF VALUES (JUN 2004)

(a) The Contractor shall, in accordance with the requirements of the Contracting Officer, prepare and submit for approval a schedule of estimated values of all parts of the work, and shall submit such quantity breakdowns pertinent thereto as the Contracting Officer may deem necessary for the proper checking of partial payment requisitions and for other administrative purposes. The total of the schedule of values shall equal the amount of the contract. The values employed in making this schedule will be used only for determining partial payments; they will not be used as a basis for determining an increase or decrease in the contract price. The listings and subdivisions of this schedule for estimated costs and quantity breakdowns shall be as approved by the Contracting Officer.

(b) The submission and approval of the schedule of values shall be a condition precedent to the making of partial payments.

(End of clause)

AOC52.236-10

Specifications and Drawings for Construction (Feb 2007)

(a) The Contractor shall keep on the site of the work a copy of the drawings and specifications, and of approved shop drawings, product data and samples and shall at all times give the Contracting Officer access thereto. Anything mentioned in the specifications and not shown on the drawings, or shown on the drawings and not mentioned in the specifications, shall be of like effect as if shown or mentioned in both. In case of difference between drawings and specifications, or in case of discrepancy either within the figures, within the drawings, or within the specifications, the matter shall be promptly submitted to the Contracting Officer, who shall promptly make a determination in writing. Any adjustment by the Contractor without such a determination shall be at its own risk and expense. The Contracting Officer shall furnish from time to time such detailed drawings and other information he considers necessary, unless otherwise provided.

(b) Shop drawings means drawings submitted to the Government by the Contractor, subcontractor, any lower tier subcontractor pursuant to a construction contract, showing in detail (1) the proposed fabrication and assembly of structural elements and (2) the installation (i.e., form, fit, and attachment details) of materials or equipment. It includes drawings, diagrams, layouts, schematics, descriptive literature, illustrations, schedules, performance and test data, and similar materials furnished by the Contractor to explain in detail specific portions of the work required by the contract.

(c) The Contractor shall--

- (1) Check all drawings furnished immediately upon receipt;
- (2) Compare all drawings and verify the figures before laying out the work;
- (3) Promptly notify the Contracting Officer of any discrepancies;
- (4) Be responsible for any errors that might have been avoided by complying with this paragraph (c); and
- (5) Reproduce and print contract drawings and specifications as needed.

(d) In general--

- (1) Large scale drawings shall govern small scale drawings; and
- (2) The Contractor shall follow figures marked on drawings in preference to scale measurements.

(e) Omissions from the drawings or specifications or the misdescription of details of work that are manifestly necessary to carry out the intent of the drawings and specifications, or that are customarily performed, shall not relieve the Contractor from performing such omitted or misdescribed details of the work. The Contractor shall perform such details as if fully and correctly set forth and described in the drawings and specifications.

(f) The work shall conform to the specifications and the contract drawings included as part of this contract.

(g) The Contractor shall submit to the Contracting Officer for approval shop drawings, product data and samples as required under the various sections of this Project Manual. The Contractor shall coordinate all such submittals, and review them for accuracy, completeness, and compliance with contract requirements and shall indicate its approval thereon as evidence of such coordination and review. Shop drawings, product data, or samples submitted to the Contracting Officer without evidence of the Contractor's approval may be returned for re-submission. The Contracting Officer will indicate an approval or disapproval of the shop drawings and if not approved as submitted shall indicate the Government's reasons therefor. Any work done before such approval shall be at the Contractor's risk. Approval by the Contracting Officer shall not relieve the Contractor from responsibility for any errors or omissions in such submittals, nor from responsibility for complying with the requirements of this contract, except with respect to variations described and approved in accordance with Paragraph (d) below.

(h) If shop drawings, product data, or samples show variations from the contract requirements, the Contractor shall describe such variations in writing, separate from the drawings, at the time of submission. If the Contracting Officer approves any such variation, the Contracting Officer shall issue an appropriate contract modification, except that, if the variation is minor or does not involve a change in price or in time of performance, a modification need not be issued.

(i) Upon completing the work under this contract, the Contractor shall furnish a complete set of all shop drawings as finally approved. These drawings shall show all changes and revisions made up to the time the equipment is completed and accepted. The Government may duplicate, use, and disclose in any manner and for any purpose shop drawings, product data or samples delivered under this contract.

(j) The provisions of this entire paragraph shall be included in all subcontracts at any tier.

(End of clause)

AOC52.236-12

PRODUCT DATA AND SAMPLES (JUN 2004)

(a) Product data shall mean information (e.g., catalog cuts, standard illustrations, drawings, performance charts, data and brochures) pertinent to a particular product, equipment or material required as a part of the work. Product data is required to establish, for the purposes of evaluation and approval, details of the product offered in response to specifications elsewhere in the contract documents. Product data pertains to significant elements such as (1) design; (2) materials; (3) components; (4) performance characteristics; and (5) methods of manufacture, assembly, construction, or operation. The term includes, in addition to the above, the manufacturer's standard printed recommendations for application and use, compliance with recognized standards of trade associations and testing agencies,

and the application of their labels and seals (if any).

(b) Samples are physical examples of materials, equipment or workmanship that will be used by the Contracting Officer to establish standards by which the work will be judged.

(c) Samples not subject to destructive tests may be retained by the Contracting Officer until completion of the work; they will then be returned to the Contractor, at his own expense, if he so requests in writing.

(End of clause)

52.243-4

Changes (Aug 1987)

(a) The Contracting Officer may, at any time, without notice to the sureties, if any, by written order designated or indicated to be a change order, make changes in the work within the general scope of the contract, including changes-

(1) In the specifications (including drawings and designs);

(2) In the method or manner of performance of the work;

(3) In the Government-furnished facilities, equipment, materials, services, or site; or

(4) Directing acceleration in the performance of the work.

(b) Any other written or oral order (which, as used in this paragraph (b), includes direction, instruction, interpretation, or determination) from the Contracting Officer that causes a change shall be treated as a change order under this clause; Provided, that the Contractor gives the Contracting Officer written notice stating-

(1) The date, circumstances, and source of the order; and

(2) That the Contractor regards the order as a change order.

(c) Except as provided in this clause, no order, statement, or conduct of the Contracting Officer shall be treated as a change under this clause or entitle the Contractor to an equitable adjustment.

(d) If any change under this clause causes an increase or decrease in the Contractor's cost of, or the time required for, the performance of any part of the work under this contract, whether or not changed by any such order, the Contracting Officer shall make an equitable adjustment and modify the contract in writing. However, except for an adjustment based on defective specifications, no adjustment for any change under paragraph (b) of this clause shall be made for any costs incurred more than 20 days before the Contractor gives written notice as required. In the case of defective specifications for which the Government is responsible, the equitable adjustment shall include any increased cost reasonably incurred by the Contractor in attempting to comply with the defective specifications.

(e) The Contractor must assert its right to an adjustment under this clause within 30 days after (1) receipt of a written change order under paragraph (a) of this clause or (2) the furnishing of a written notice under paragraph (b) of this clause, by submitting to the Contracting Officer a written statement describing the general nature and amount of the proposal, unless this period is extended by the Government. The statement of proposal for adjustment may be included in the notice under paragraph (b) of this clause.

(f) No proposal by the Contractor for an equitable adjustment shall be allowed if asserted after final payment under this contract.

AOC52.243-1

CHANGES - SUPPLEMENT (JUN 2004)

(a) Definitions.

(1) A change order is a unilateral contract modification, signed by the Contracting Officer, which describes and identifies a particular change in the requirements as permitted by the FAR clause, 52.243-4, Changes and authorizes the contractor to begin performance with the changed requirements. The change order may reference pertinent oral or written directives, provide an adjustment to the contract price and/or time for performance, and direct the contractor to submit a proposal for definitization of the change order.

(2) A supplemental agreement is a bilateral contract modification, signed by the contractor and the Contracting Officer, which either authorizes the contractor to begin performance with the changed requirements in accordance with the equitable adjustment agreed to prior to commencement of performance of the changed requirements or definitizes a change order after agreement of an equitable adjustment to the contract.

(3) Request for Proposal. A request by the Contracting Officer or his duly authorized representative for the contractor to submit a proposal for requirements contemplated to be changed. Such proposal shall be submitted within the time limit specified in the request and in accordance with the requirements and limitations of this clause.

(b) Authorization of changes. All changes to contract requirements will be authorized in writing by the Contracting Officer through one of the following methods:

(1) A Supplemental Agreement, with the concurrence of the contractor; or

(2) A unilateral Change Order.

(c) Submission of proposals and cost breakdowns by the contractor.

(1) Proposals for changes to the contract requirements shall include a brief description of the change; a breakdown of costs as outlined hereinafter; and a time impact analysis (fragnet).

(2) In considering proposals for changes involving added requirements, omitted requirements, or any combination thereof, the Contracting Officer or his duly authorized representative will make check-estimates in such detail as he deems necessary with the view of arriving at equitable adjustments. With each proposal, the contractor shall submit separately an itemized breakdown as per "Exhibit A" hereof, which shall include, but not be limited to, the following:

(i) Direct labor costs;

(ii) Social Security and Unemployment Insurance Taxes;

(iii) Workmen's compensation and general liability insurance;

(iv) Direct material quantities and unit prices (separated into trades);

(v) Construction equipment;

(vi) Overhead; and

(vii) Profit.

(3) If the contractor believes that the change in the contract requirements affects the contract period of performance, as required by AOC52.211-5, Commencement, Prosecution, and Completion of Work, of the Supplementary Conditions, appropriate substantiation must be submitted for evaluation/review.

(4) A complete proposal, including breakdown of cost and time impact, shall be submitted by the contractor within the time frame stipulated in calendar days by the Government for each proposed change. Generally, complete proposals shall be submitted by the contractor within 7 calendar days after the contractor receives the request for proposal, although this time frame may be adjusted for more complex or more urgent requirements. Except as provided by an individual contract modification, no payment for a change order will be made until a supplemental agreement has been signed by the contractor and the Contracting Officer. If complete proposals are not received timely, the Contracting Officer, after consultation with his authorized representative, may determine the cost of the change and the time impact and issue a change order based upon this determination with the stipulation that if a supplemental agreement is not negotiated within a reasonable amount of time, this determination will be final and conclusive, subject only to the contractor's rights of appeal as provided in AOC52.233-1, Disputes, of the General Conditions.

(d) Allowances for overhead and profit.

(1) The following percentages will be allowed for overhead and profit:

(i) The contractor shall receive, as a percentage of the cost of all work performed by his own organization, an amount not to exceed 10% overhead and not to exceed 10% profit; and

(ii) If subcontractor(s) are involved in the change, a fee in an amount not to exceed 10% as a percentage of the total price of the subcontractor portion of the change.

(iii) Subcontractor(s) to the prime contractor (first tier subcontractor(s)) shall receive, as a percentage of the cost of all work performed by or for it, a total amount not to exceed 10% overhead and not to exceed 10% profit.

(iv) The percentages for fees, overhead, and profit permitted by the above shall be allowed only for the contractor and its first tier subcontractors. Percentages for fees, overhead, and profit in any amount will not be allowed for subcontractors of any other tier.

(2) Percentages for overhead allowed are deemed to include, but shall not be limited to, the following:

(i) Field Overhead Items.

(A) Trailer;

(B) Storage Facilities;

(C) Contractor's and subcontractor's superintendence;

(D) Construction equipment/tools, except those that are specially required for a specific change;

(E) Utilities;

(F) Contractor's and subcontractor's field office, administrative/support staff;

(G) Cost of preparing record drawing changes, correspondence, etc., relating to the contract;

(H) Job site safety aids; and

(I) Cleaning and maintenance of nuisance debris from jobsite.

(ii) Office Overhead Items for Contractor and Subcontractors.

(A) Maintenance/operation of principal or branch offices;

(B) Personnel costs;

(C) Cost for preparing correspondence, fragnets, etc., relating to the contract; and

(D) Cost of insurance and bonds, except for insurance costs relating to direct labor, as outlined in "Exhibit A".

(iii) For changes which include custom items unique to the project and which are fabricated off-site, the fabricator, whether the contractor or a subcontractor at any tier, shall furnish a breakdown of costs associated with the work in the fabricating plant. This breakdown shall include labor, material, equipment and overhead/plant costs in sufficient detail to allow for review by the Contracting Officer or his duly authorized representative. Costs charged to overhead/plant shall be allowable costs for the fabricator, whether he is the contractor or a subcontractor at any tier, provided that the costs claimed are consistent with the provisions of Subpart 31.203 of the Federal Acquisition Regulation (Chapter 1, Title 48, Code of Federal Regulations). An amount not to exceed 10% of the cost of the fabricated item will be allowed for the fabricator's profit. If the fabricator is a subcontractor, the overhead and profit percentages for the contractor and any subcontractor at a higher tier having a contractual relationship with the fabricator shall be allowed in accordance with this clause.

(e) Changes involving decreases in price. For changes involving only a decrease in price, the contractor and subcontractors shall return as credit for overhead and profit those same percentages which are allowed for like changes involving increases in price. On changes involving both an increase and a decrease in price, overhead and profit will be allowed only on the net increase.

(f) Changes involving increases or decreases on basis of contract specified unit prices. No percentages for overhead and profit will be added to, or deleted from, any unit prices in event of an increase or decrease in the contract requirements on the basis of contractual unit prices.

EXHIBIT A

TYPICAL FORM OF BREAKDOWN FOR PRICE ADJUSTMENT

SUBCONTRACTORS' BREAKDOWN

Items Involved	Quantities	Unit Cost	Equipment	Material	Labor	Extensions		Unit Cost
						Totals	Final Totals	
Excavation (Identify)								
* Volume								
* Crane Operator								
* Laborers								
Shoring (Identify)								

Items Involved	Quantities	Unit Cost	Equipment	Material	Labor	Totals	Final Totals	Unit Cost
* Area								
* Welder								
Subcontractor Total								

PRIME CONTRACTOR'S BREAKDOWN

						Extensions		
Items Involved	Quantities	Unit Cost	Equipment	Material	Labor	Totals	Final Totals	Unit Cost
West Wall (Cinder Block)								
* Area								
* Block 8x8x16								
* Mortar								
* Mason								
* Laborer								
Subtotal								
Prime Contractor's Total								
Prime Contractor's Overhead and Profit on Subcontractor								
Total								

(End of Clause)

AOC52.244-1**AWARD OF SUBCONTRACTS AND OTHER CONTRACTS FOR PORTIONS OF THE WORK (SEP 2005)**

- (a) The Contractor is responsible for coordination of all work performed by its own workforce and those of its subcontractors. Each subcontractor shall be experienced in and capable of performing in a satisfactory manner all work in his speciality, and shall meet the standard of competence established for the Contractor.
- (b) The Contractor shall be responsible for all acts of subcontractors employed by him under this contract, and for their compliance with all terms and provisions of the contract applicable to their performance. The Contractor shall continuously coordinate the work of all sub-contractors to assure proper processing and progress of the Work. The Contractor shall require each subcontractor to (1) examine the project schedule, shop drawings and the work of other trades and all sections of the specifications to the extent necessary for satisfactory Installation of his work, and connection between his work and the work of other trades; (2) coordinate his work accordingly; and (3) cooperate with other trades toward timely and satisfactory completion of the entire work.
- (c) Organization of the specifications into sections and subsections and the arrangement of drawings shall not control the Contractor in dividing work among subcontractors or in establishing the extent of work to be performed by any trade.
- (d) The Government reserves the right to require dismissal of any subcontractor who, by reason of previous unsatisfactory work on AOC projects or for any other reason, is considered by the Contracting Officer to be incompetent or otherwise objectionable for performing work under this contract.
- (e) Nothing contained in the contract documents shall create any contractual relations between any subcontractor and the Government.

(End of clause)

AOC52.245-2**GOVERNMENT-FURNISHED PROPERTY (NOV 2004)**

- (a) For the purposes of this clause, Government-furnished property includes cell phones and telephones, personal digital assistants, computers (including laptops), electronic devices, services such as network access, tools, furnished space, storage, utilities, furnishings, equipment, and any other item or service provided by the AOC to the contractor.

(b) No AOC equipment or property can be provided under this contract unless specifically negotiated as part of the award price. If, after contract award, it becomes necessary or advisable to issue AOC property to the contractor, the contract price shall be reduced by a reasonable amount that reflects the price the contractor would pay if providing the property.

(c) The Contracting Officer's Technical Representative (COTR) for this contract is responsible for coordinating the issuance and return of Government-furnished property.

(d) Any Government-furnished property provided to the contractor for use during performance of this contract shall be issued to the contractor's representative and recorded on AOC Form 1423, AOC PROPERTY ISSUED TO CONTRACTORS. The contractor's representative shall be responsible for ensuring the proper care and use of the Government-furnished property, whether used by the contractor representative or another contractor employee. Government-furnished property provided by the AOC can be used only for the conduct of official business on behalf of the AOC. The contractor is specifically prohibited from using AOC-furnished property for personal use or to conduct operations that benefit other Government agency contracts or other contractor activities that do not directly support AOC contracts.

(e) All information technology property that requires interface or connection to the AOC network must be provided by the AOC. The use of non-AOC IT property that requires interface or connection to the AOC network is strictly prohibited.

(f) All contractor employees who require access to the AOC network or who are issued a personal digital assistant must complete and sign the Non-disclosure Agreement for Contract Employees Conditional Access to Sensitive but Unclassified Information for The Architect of The Capitol before access will be granted. The COTR is responsible for providing the non-disclosure agreements to the AOC Office of Information Resources Management.

(g) All Government-furnished property shall be returned by the contractor to the COTR in the same condition as issued, with allowances for wear and tear that occurs with reasonable care and use. Failure to return Government-furnished property or the return of Government-furnished property that has not been properly maintained and used may result in a reduction to the contract price that reflects the market replacement value of the property or the market price to repair or restore the property to its condition when issued to the contractor.

(End of clause)

AOC52.246-1

FINAL INSPECTION AND ACCEPTANCE - CONSTRUCTION - SUPPLEMENT (SEP 2005)

(a) No inspection or other action of the Government shall be construed to constitute a final acceptance of any portion of the work under this contract until all work under the contract is completed. None of the work under the contract shall be deemed to be finally accepted until the Contractor, upon completion and final inspection of all work, is notified in writing of final acceptance of work under the contract, or in lieu thereof, until final payment of the final voucher as prescribed in FAR 52.232-5, Payments Under Fixed-Price Construction Contracts. The provisions of FAR clause 52.246-12, Inspection of Construction are hereby modified by the provisions of this paragraph with respect to the finality of acceptance of any portion of the work by the Government prior to completion of all work under the contract.

(b) The Contractor shall notify the Contracting Officer, at least 10 days in advance, of the date the work will be fully complete and ready for final inspection. Any additional costs incurred by the Government due to necessary reinspection of work found not ready for final inspection upon the Contractor's notice of completion will be charged to the Contractor and deducted from the contract price.

(End of clause)

AOC52.246-6

ADDITIONAL WARRANTY COVERAGE (JUN 2004)

If the Contractor receives from any manufacturer, supplier or subcontractor additional warranty coverage on the whole or any component of the work required by this contract, in the form of time including any pro rata arrangements, or the Contractor generally extends to his commercial customers a greater or extended warranty coverage, the Government shall receive corresponding warranty benefits.

(End of clause)

52.252-2

Clauses Incorporated By Reference (Feb 1998)

This contract incorporates one or more clauses by reference, with the same force and effect as if they were given in full text. Upon

request, the Contracting Officer will make their full text available. Also, the full text of a clause may be accessed electronically at this/these address(es):

www.gsa.gov or www.govcon.com

(End of clause)

Clauses By Reference

Clause	Title	Date
52.246-12	Inspection of Construction	11/08/2006

Clauses By Reference

Clause	Title	Date
52.222-37	Employment Reports On Special Disabled Veterans, Veterans Of The Vietnam Era, and Other Eligible Veterans	11/08/2006
52.228-2	Additional Bond Security	11/08/2006
52.232-5	Payments under Fixed-Price Construction Contracts	11/08/2006
52.236-26	Preconstruction Conference	11/08/2006
52.242-14	Suspension of Work	11/08/2006
52.203-3	Gratuities	11/08/2006
52.203-5	Covenant Against Contingent Fees	11/08/2006
52.203-6	Restrictions On Subcontractor Sales To The Government	11/08/2006
52.215-2	Audit and Records--Negotiation	11/08/2006
52.222-4	Contract Work Hours and Safety Standards Act - Overtime Compensation	11/08/2006
52.222-6	Davis Bacon Act	11/08/2006
52.222-7	Withholding of Funds	11/08/2006
52.222-8	Payrolls and Basic Records	11/08/2006
52.222-9	Apprentices and Trainees	11/08/2006
52.222-10	Compliance with Copeland Act Requirements	11/08/2006
52.222-11	Subcontracts (Labor Standards)	11/08/2006
52.222-12	Contract Termination-Debarment	11/08/2006
52.222-13	Compliance with Davis-Bacon and Related Act Regulations.	11/08/2006
52.222-14	Disputes Concerning Labor Standards	11/08/2006
52.222-15	Certification of Eligibility	11/08/2006
52.222-27	Affirmative Action Compliance Requirements for Construction	11/08/2006

Clause	Title	Date
52.222-36	Affirmative Action For Workers With Disabilities	11/08/2006
52.222-35	Equal Opportunity For Special Disabled Veterans, Veterans of the Vietnam Era and Other Eligible Veterans	11/08/2006
52.223-6	Drug Free Workplace	11/08/2006
52.227-4	Patent Indemnity-Construction Contracts	11/08/2006
52.229-3	Federal, State And Local Taxes	11/08/2006
52.232-23	Assignment Of Claims	11/08/2006
52.236-2	Differing Site Conditions	11/08/2006
52.236-3	Site Investigation and Conditions Affecting the Work	11/08/2006
52.236-6	Superintendence by the Contractor	11/08/2006
52.236-7	Permits and Responsibilities	11/08/2006
52.236-8	Other Contracts	11/08/2006
52.236-11	Use and Possession Prior to Completion	11/08/2006
52.236-13	Accident Prevention	11/08/2006
52.242-13	Bankruptcy	11/08/2006
52.245-2	Government Property (Fixed Price Contracts)	11/08/2006
52.246-21	Warranty of Construction	11/08/2006
52.249-2	Termination For Convenience Of The Government (Fixed-Price)	09/01/1996
52.249-10	Default (Fixed-Price Construction)	11/08/2006

Supplementary Conditions

Sec. F 52.252-1

52.252-1 SOLICITATION PROVISIONS INCORPORATED BY REFERENCE (FEB 1998)

This solicitation incorporates one or more solicitation provisions by reference, with the same force and effect as if they were given in full text. Upon request, the Contracting Officer will make their full text available. The offeror is cautioned that the listed provisions may include blocks that must be completed by the offeror and submitted with its quotation or offer. In lieu of submitting the full text of those provisions, the offeror may identify the provision by paragraph identifier and provide the appropriate information with its quotation or offer. Also, the full text of a solicitation provision may be accessed electronically at this/these address(es):

www.gsa.gov or www.arnet.gov

(End of provision)

Sec. G 52.252-1

52.252-1 SOLICITATION PROVISIONS INCORPORATED BY REFERENCE (FEB 1998)

This solicitation incorporates one or more solicitation provisions by reference, with the same force and effect as if they were given in full text. Upon request, the Contracting Officer will make their full text available. The offeror is cautioned that the listed provisions may include blocks that must be completed by the offeror and submitted with its quotation or offer. In lieu of submitting the full text of those provisions, the offeror may identify the provision by paragraph identifier and provide the appropriate information with its quotation or offer. Also, the full text of a solicitation provision may be accessed electronically at this/these address(es):

www.gsa.gov or www.arnet.gov

(End of provision)

AOC52.201-1

CONTRACTING OFFICERS AUTHORITY (JUN 2004)

The Contracting Officer is the only person authorized to make or approve any changes in any of the requirements of this contract, notwithstanding any provision contained elsewhere in this contract. In the event that the Contractor makes any change at the direction of any person other than the Contracting Officer, the change will be considered to have been made without authority and no adjustment will be made in the contract price to cover any increase in costs incurred as a result thereof.

(End of clause)

AOC52.201-2

CONTRACTING OFFICERS TECHNICAL REPRESENTATIVE (COTR) (MAR 2005)

The Government shall provide the name, address and telephone number of the COTR at the time of contract award and the duties thereby delegated to that person. Any subsequent change to the individual or the individual's responsibilities will be confirmed in writing by the Contracting Officer. In no instance will the COTR be delegated authority to order any change in the contractor's performance which would affect (a) cost or schedule for contracts for services or supplies, or (b) scope, the completion date for intermediate phases or milestones, or overall completion date for contracts for construction.

(End of clause)

AOC52.211-5

COMMENCEMENT, PROSECUTION AND COMPLETION OF WORK (SEP 2004)

(a) All work to be performed under this contract shall be completed within [495] calendar days after the date of contract award. No work under this contract shall be performed on Saturdays, Sundays or Federal holidays and, for work performed in the District of

Columbia, Presidential Inauguration Day, except with prior approval of the Contracting Officer.

(b) Time for completion of the contract work will be adjusted only in accordance with applicable clauses in the GENERAL CONDITIONS (e.g., "Differing Site Conditions", "Changes", "Changes - Supplement", "Suspension of Work").

(End of clause)

AOC52.223-5

SPECIAL SECURITY REQUIREMENTS - SERVICES (AUG 2006)

(a) All vehicles, and contents, used by the Contractor or his subcontractors, which enter or leave United States Government property during performance of the work, will be subject to clearance, inspection and identification procedures conducted by the United States Capitol Police.

(b) All persons entering the Legislative Branch Buildings shall gain access to the building by passing through x-ray screening devices. In addition, all handbags and all hand-carried items shall be screened by x-ray devices prior to their entry into the building.

(c) All personnel provided by the Contractor and employed on the site of the work will be subject to a security background investigation. Each employee will be required to fill out an I.D. Request Form and U.S. Capitol Police Request for check of Criminal History Records and each employee will be photographed and fingerprinted. The Contractor shall provide any assistance required by any of its employees in completing the forms.

(d) Prior to commencement of work, the contractor and all designated on-site employees will be required, on a one-time basis, to be fingerprinted in Washington D.C. The location for the Electronic Fingerprinting Service is the U.S. Capitol Hill Police, Fairchild Building, 499 South Capitol Street SW, Washington, DC 20003.

(e) Within seven (7) calendar days after the date of contract award, the Contractor shall submit to the Contracting Officer's Technical Representative (COTR) a list of all employees proposed to be employed on this contract. This list shall include the employee's full name, date of birth and social security number.

(f) While security background investigations are in process, the Contractor's employees must not be granted access to the Capitol Hill complex to perform work or provide services for the AOC unless they are escorted by an AOC staff member. "Escorted" is defined to mean that the AOC staff member will remain with the employee(s) at all times during the performance of the work. Any of the Contractor's employees who are perceived by the Contracting Officer as a security risk as a result of evidence discovered in the background security investigation will not be issued an Identification Card, will be denied access to the site of the work, and the Contractor will be directed to remove such employee from performance of any of the contract work, whether it be on or off the work site. Any contractor employee denied access to the site of work on a contract or task/delivery order as a result of a security investigation may not apply for access to any other AOC/U.S. Supreme Court contract or task/delivery order work site.

(g) An identification card, with photograph, will be prepared for each employee of the Contractor requiring access to the site. The identification card shall be dated to indicate the period of time for which it is to remain valid - from the date the employee reports for duty until the applicable date which occurs first: the expiration of the contract, or the last date of the employee's tour of duty with the Contractor. All contractor personnel must wear the ID badge whenever on the Capitol complex premises or when attending off-site functions on behalf of the AOC. ID badges must be worn in such a manner that contractor personnel can be easily identified as such.

(h) All persons entering the Legislative Branch Buildings shall gain access to the building by passing through a magnetometer. In addition, all handbags and all hand-carried items shall be screened by x-ray devices prior to their entry into the building.

(i) The Contractor is fully responsible to return:

(1) The ID badge of any individual employee, including subcontractor personnel, who is removed for any reason including but not limited to illness, or dismissal;

(2) The ID badges of all contractor employees, including subcontractor personnel, whose performance under the contract is completed in advance of final contract job completion; and

(3) All outstanding ID badges issued for the contractor and its employees, including subcontractor personnel, within 24 hours of on site contract job completion.

(j) ID badges are to be hand delivered by the contractor within 24 hours of any of the events listed under (f) above to the Contracting Officer's Representative.

(End of clause)

AOC52.223-8

DELIVERY VEHICLE INSPECTION REQUIREMENTS (DEC 2006)

(a) All vehicles and contents used by the Contractor or his subcontractors which enter or leave United States Government property during performance of work under this contract will be subject to clearance, inspection, and identification procedures conducted by the United States Capitol Police.

(b) Mobile Vehicle and Cargo Inspection System (Mobile VACIS). All delivery vehicles carrying fuel, garbage, or similar cargo that cannot be offloaded for inspection and security screening shall utilize the Mobile VACIS located at Third and Pennsylvania Avenue, NW, Washington, DC, for inspection prior to making deliveries to any building within the Capitol Complex, including, but not limited to, the U.S. Capitol Building; the U.S. Botanic Garden; the Hart, Dirksen, and Russell Senate Office Buildings; the Rayburn, Longworth, Cannon, and Ford House Office Buildings; the Thomas Jefferson, John Adams, and James Madison Memorial Library of Congress buildings; the Capitol Power Plant; the Capitol Visitors Center; and the U.S. Supreme Court and Thurgood Marshall Federal Judiciary Buildings.

(c) 4700 Shepherd Parkway SW inspection facility. All other vehicles making deliveries to the above listed locations except for the Thomas Jefferson, John Adams, and James Madison Memorial Library of Congress buildings and the U. S. Supreme Court shall utilize the off-site inspection and screening facilities at 4700 Shepherd Parkway SW, Washington, DC 20032.

(d) For all deliveries within seven calendar days or prior to the first delivery, the contractor shall provide the following information to the U.S. Capitol Police:

- (1) List of drivers;
- (2) Date of birth for each driver;
- (3) Social Security Number of each driver;
- (4) Vehicle make;
- (5) Vehicle model;
- (6) License tag number and state where vehicle is licensed;
- (7) Color of vehicle; and
- (8) Contractor name, if shown on the vehicle.

(e) Information for deliveries made through the Mobile VACIS unit must be faxed to (202) 228-4313. For verification of receipt, the contractor may call (202) 224-9728. Updates to the information for Mobile VACIS deliveries must be sent to the U.S. Capitol Police throughout the period of performance of the contract.

(f) Information for deliveries made through the Shepherd Parkway facility must be faxed to (202) 226-0571. For verification of receipt, the contractor may call (202) 226-0905. Updates to the information must be renewed April 30, August 31, and December 31 of each year and provided to the U. S. Capitol Police whenever repetitive deliveries are anticipated.

(End of clause)

AOC52.236-11

SUBMITTALS (JUN 2004)

(a) The Contractor shall deliver all required submittals within the times specified elsewhere in this contract. Unless specifically stated otherwise, four (4) sets of each item shall be delivered by the contractor to the Contracting Officer's Technical Representative. An in-depth description of these submittals can be found in the appropriate technical sections of the specification. Any Schedule of Work prepared shall reflect delivery of these items. Failure to provide timely delivery of these submittals may be considered to be grounds for termination for default.

(b) The Government will review the submittals and either approve them as submitted, or mark required changes on them. If change are required, the Contractor shall deliver revised submittals for approval by the Government which incorporate all of the required changes within two weeks after receipt by the Contractor of the marked-up submittals.

(End of clause)

Sec. H 52.252-1

52.252-1 SOLICITATION PROVISIONS INCORPORATED BY REFERENCE (FEB 1998)

This solicitation incorporates one or more solicitation provisions by reference, with the same force and effect as if they were given in full text. Upon request, the Contracting Officer will make their full text available. The offeror is cautioned that the listed provisions may include blocks that must be completed by the offeror and submitted with its quotation or offer. In lieu of submitting the full text of those provisions, the offeror may identify the provision by paragraph identifier and provide the appropriate information with its quotation or offer. Also, the full text of a solicitation provision may be accessed electronically at this/these address(es):

www.gsa.gov or www.arnet.gov

(End of provision)

Representations and Certifications

52.203-2

Certificate of Independent Price Determination (Apr 1985)

(a) The offeror certifies that--

(1) The prices in this offer have been arrived at independently, without, for the purpose of restricting competition, any consultation, communication, or agreement with any other offeror or competitor relating to--

(i) Those prices;

(ii) The intention to submit an offer; or

(iii) The methods or factors used to calculate the prices offered.

(2) The prices in this offer have not been and will not be knowingly disclosed by the offeror, directly or indirectly, to any other offeror or competitor before bid opening (in the case of a sealed bid solicitation) or contract award (in the case of a negotiated solicitation) unless otherwise required by law; and

(3) No attempt has been made or will be made by the offeror to induce any other concern to submit or not to submit an offer for the purpose of restricting competition.

(b) Each signature on the offer is considered to be a certification by the signatory that the signatory--

(1) Is the person in the offeror's organization responsible for determining the prices being offered in this bid or proposal, and that the signatory has not participated and will not participate in any action contrary to paragraphs (a)(1) through (a)(3) of this provision; or

(2)(i) Has been authorized, in writing, to act as agent for the following principals in certifying that those principals have not participated, and will not participate in any action contrary to paragraphs (a)(1) through (a)(3) of this provision
[insert full name of person(s) in the offeror's organization responsible for determining the prices offered in this bid or proposal, and the title of his or her position in the offeror's organization];

(ii) As an authorized agent, does certify that the principals named in subdivision (b)(2)(i) of this provision have not participated, and will not participate, in any action contrary to paragraphs (a)(1) through (a)(3) of this provision; and

(iii) As an agent, has not personally participated, and will not participate, in any action contrary to paragraphs (a)(1) through (a)(3) of this provision.

(c) If the offeror deletes or modifies paragraph (a)(2) of this provision, the offeror must furnish with its offer a signed statement setting forth in detail the circumstances of the disclosure.

(End of provision)

52.204-3

Taxpayer Identification (Oct 1998)

(a) *Definitions.*

"Common parent," as used in this provision, means that corporate entity that owns or controls an affiliated group of corporations that files its Federal income tax returns on a consolidated basis, and of which the offeror is a member.

"Taxpayer Identification Number (TIN)," as used in this provision, means the number required by the Internal Revenue Service (IRS) to be used by the offeror in reporting income tax and other returns. The TIN may be either a Social Security Number or an Employer Identification Number.

(b) All offerors must submit the information required in paragraphs (d) through (f) of this provision to comply with debt collection requirements of 31 U.S.C. 7701(c) and 3325(d), reporting requirements of 26 U.S.C. 6041, 6041A, and 6050M, and implementing regulations issued by the IRS. If the resulting contract is subject to the payment reporting requirements described in Federal

Acquisition Regulation (FAR) 4.904, the failure or refusal by the offeror to furnish the information may result in a 31 percent reduction of payments otherwise due under the contract.

(c) The TIN may be used by the Government to collect and report on any delinquent amounts arising out of the offeror's relationship with the Government (31 U.S.C. 7701(c)(3)). If the resulting contract is subject to the payment reporting requirements described in FAR 4.904, the TIN provided hereunder may be matched with IRS records to verify the accuracy of the offeror's TIN.

(d) *Taxpayer Identification Number (TIN).*

__TIN: _____.

__TIN has been applied for.

__TIN is not required because:

__Offeror is a nonresident alien, foreign corporation, or foreign partnership that does not have income effectively connected with the conduct of a trade or business in the United States and does not have an office or place of business or a fiscal paying agent in the United States;

__Offeror is an agency or instrumentality of a foreign government;

__Offeror is an agency or instrumentality of the Federal Government.

(e) *Type of organization.*

__Sole proprietorship;

__Partnership;

__Corporate entity (not tax-exempt);

__Corporate entity (tax-exempt);

__Government entity (Federal, State, or local);

__Foreign government;

__International organization per 26 CFR 1.6049-4;

__Other _____.

(f) *Common parent.*

__Offeror is not owned or controlled by a common parent as defined in paragraph (a) of this provision.

__Name and TIN of common parent:

Name _____.

TIN _____.

(End of provision)

AOC52.204-2

DATA UNIVERSAL NUMBERING SYSTEM (DUNS) NUMBER (JUN 2004)

(a) The offeror shall enter, in the space provided below, the DUNS number that identifies the offeror's name and address exactly as stated in the offer. The DUNS number is a nine-digit number assigned by Dun and Bradstreet Information Services.

(b) If the offeror does not have a DUNS number, it should contract Dun and Bradstreet directly to obtain one. A DUNS number will be provided immediately by telephone at no charge to the offeror. For information on obtaining a DUNS number, the offeror, if located within the United States, should call Dun and Bradstreet at 1-800-333-0505. The offeror should be prepared to provide the following information:

- (1) Company name,
- (2) Company address;
- (3) Company telephone number;
- (4) Line of business;
- (5) Chief executive officer/key manager;
- (6) Date the company was started;
- (7) Number of people employed by the company; and
- (8) Company affiliation.

(c) Offerors located outside the United States may obtain the location and phone number of the local Dun and Bradstreet Information Services office from the Internet home page at <http://www.customerservice@dnb.com>. If an offeror is unable to locate a local service center, it may send an e-mail to Dun and Bradstreet at globalinfo@mail.dnb.com.

(d) Enter DUNS number:_____.

(End of provision)

AOC52.204-3

REPRESENTATIONS AND CERTIFICATIONS (NOV 2004)

The offeror shall properly execute and submit with its offer the Representations and Certifications contained herein. Insert information in spaces provided as applicable.

(End of provision)

AOC52.215-8

AUTHORIZED NEGOTIATORS (JUN 2004)

The offeror represents that following persons are authorized to negotiate on its behalf with the Government in connection with this Request for Proposal:

Name: _____ Title: _____

Telephone: _____ E-Mail: _____

Name: _____ Title: _____

Telephone: _____ E-Mail: _____

Name: _____ Title: _____

Telephone: _____ E-Mail: _____

(End of provision)

Solicitation Conditions

52.211-6

Brand Name or Equal (Aug 1999)

(a) If an item in this solicitation is identified as "brand name or equal," the purchase description reflects the characteristics and level of quality that will satisfy the Government's needs. The salient physical, functional, or performance characteristics that "equal" products must meet are specified in the solicitation.

(b) To be considered for award, offers of "equal" products, including "equal" products of the brand name manufacturer, must-

(1) Meet the salient physical, functional, or performance characteristic specified in this solicitation;

(2) Clearly identify the item by-

(i) Brand name, if any; and

(ii) Make or model number;

(3) Include descriptive literature such as illustrations, drawings, or a clear reference to previously furnished descriptive data or information available to the Contracting Officer; and

(4) Clearly describe any modifications the offeror plans to make in a product to make it conform to the solicitation requirements. Mark any descriptive material to clearly show the modifications.

(c) The Contracting Officer will evaluate "equal" products on the basis of information furnished by the offeror or identified in the offer and reasonably available to the Contracting Officer. The Contracting Officer is not responsible for locating or obtaining any information not identified in the offer.

(d) Unless the offeror clearly indicates in its offer that the product being offered is an "equal" product, the offeror shall provide the brand name product referenced in the solicitation.

(End of provision)

AOC52.215-1

INSTRUCTIONS TO OFFERORS (FEB 2005)

(a) Definitions. As used in this provision --

Proposal modification is a change made to a proposal before the solicitation's closing date and time, or made in response to an amendment, or made to correct a mistake at any time before award.

Proposal revision is a change to a proposal made after the solicitation closing date, at the request of or as allowed by a Contracting Officer as the result of negotiations.

Time, if stated as a number of days, is calculated using calendar days, unless otherwise specified, and will include Saturdays, Sundays, and legal holidays, including Presidential Inauguration Day. However, if the last day falls on a Saturday, Sunday, or legal holiday, including Presidential Inauguration Day, then the period shall include the next working day.

(b) Offerors are expected to examine the entire solicitation and all instructions. Failure to do so will be at the offeror's risk. Each offeror shall furnish the information required by the solicitation. The offeror will be held responsible for full knowledge of all information contained therein.

(c) Packaging, transmission, and tracking of proposals. (1) Proposals, modifications, and revisions shall be enclosed, in the quantities specified elsewhere in this solicitation, in sealed envelopes. With each copy of the form entitled SOLICITATION, OFFER, AND AWARD (Construction, Alteration, or Repair), enclose the completed Schedule page, Bid Guarantee, if required, and Representations and Certifications. Address envelopes to: Architect of the Capitol, Procurement Division, Ford House Office Building, Attn: Ryan Kirkwood, Room H2-263 Bid Room, Second and D Streets, S.W., Washington, DC 20515. Offeror shall place the OF-17, Offer Label, on the exterior of the package on the same side as the address, or write Bid Documents Enclosed, H2-263 Bid Room, and

write the solicitation number, time and date for receipt of offers on the exterior of the package on the same side as the address. Telegraphic or facsimile proposals and modifications will not be considered.

(2) Current security requirements established by the U.S. Capitol Police to screen mail being delivered to the U.S. Capitol Complex of buildings preclude the use of U. S. Postal Service by offerors to deliver their proposals submitted in response to this solicitation. In addition, because all packages must be screened for security purposes at a central location prior to their delivery, the Architect of the Capitol cannot accept packages containing offers hand carried directly to the Bid Room address within the Ford House Office Building, or any other location in the U.S. Capitol Complex of buildings. See Notice for Delivery on the front of the solicitation.

(3) To assist in tracking of proposals, offerors are requested to fax a copy of their signed Solicitation, Offer and Award form as well as a copy of the FEDEX or UPS receipt to Ryan Kirkwood to (202) 226-1947 at the time of the issuance of their proposal.

(4) The only acceptable method by which offerors can deliver their responses to this solicitation shall be via Federal Express (FEDEX) or United Parcel Service (UPS). Offers submitted via any other method will be rejected. OFFERORS - DO NOT MAIL YOUR OFFER BY REGULAR U.S. MAIL. See notice attached to this solicitation for special instructions.

(d) Submission, modification, revision, and withdrawal of proposals. (1) Offerors are responsible for submitting proposals and any modifications or revisions so as to reach the Government office designated in the solicitation by the time specified in the solicitation. If no time is specified in the solicitation, the time for receipt is 4:30 p.m. local time, for the designated Government office on the date that the proposal or revision is due.

(2) Any proposal, modification, or revision received at the Government office designated in the solicitation after the exact time specified for receipt of offers is late and will not be considered unless it is received before award is made, the Contracting Officer determines that accepting the late offer would no unduly delay the acquisition, and-

(i) If it was transmitted through an electronic commerce method authorized by the solicitation, it was received at the initial point of entry to the Government infrastructure not later than 5:00 p.m. one working day prior to the date specified for receipt of proposals;

(ii) There is acceptable evidence to establish that it was received at the Government installation designated for receipt of proposals and was under the Government's control prior to the time set for receipt of proposals; or

(iii) It is the only proposal received.

(3) However, a late modification of an otherwise successful proposal that makes its terms more favorable to the Government, will be considered at any time it is received and may be accepted.

(4) Acceptable evidence to establish the date of receipt at the Government installation includes the time/date stamp of that installation on the offer wrapper, other documentary evidence of receipt maintained by the installation, or oral testimony or statements of Government personnel.

(5) If an emergency or unanticipated event interrupts normal Government processes so that offers cannot be received at the Government office designated for receipt of proposals by the exact time specified in the solicitation and urgent Government requirements preclude amendment of the solicitation, the time specified for receipt of proposals will be deemed to be extended to the same time of day specified in the solicitation on the first work day on which normal Government processes resume.

(6) Proposals may be withdrawn by written notice received at any time before award. Proposals may be withdrawn in person by an offeror or an authorized representative if the identity of the person requesting withdrawal is established and the person signs a receipt for the proposal before award.

(End of provision)

AOC52.215-2

INTERPRETATIONS AND AMENDMENTS (JUN 2004)

(a) Any prospective offeror desiring an explanation or interpretation of the solicitation, drawings, specifications, etc., must request it in writing no later than fourteen calendar days prior to the date established for receipt of offers. Oral explanations or instructions given before the award of a contract will not be binding.

(b) Prospective offerors shall request the Contracting Officer, in writing, via FAX or e-mail for an interpretation or correction of any ambiguity, inconsistency, or error in the contract documents which they may discover or which should have been discovered by a reasonably prudent offeror. Such requests or objections to materials or methods of construction shown or specified shall be directed to the attention of the Contracting Officer at least fifteen (15) calendar days prior to the date specified for receipt of proposals. Written requests shall be transmitted via e-mail to rkirkwoo@aoc.gov or via facsimile to (866) 837-6609.

(c) Any interpretations or corrections, as well as any additional modifications the Contracting Officer may desire to include, will be in the form of amendments, in writing, which will be sent on the same date to all offerors if that information is necessary in submitting offers or if the lack of it would be prejudicial to other prospective offerors and shall become a part of any subsequent contract. The Contracting Officer reserves the right to answer only such questions as have, in his opinion, a definite bearing upon the proposals to be submitted.

(1) Offerors shall acknowledge the receipt of all amendments to the solicitation by:

(i) Signing and returning the amendment;

(ii) Identifying the amendment number and date in the space provided for this purpose on the form for submitting a offer;

(iii) Letter or telegram; or

(iv) Facsimile, if facsimile offers are authorized in the solicitation.

(2) The Government must receive the acknowledgment by the time and at the place specified for receipt of offers.

(d) Requests for oral interpretations or any other interpretations not made by amendments will not be accepted, and any information that may possibly be gained by offerors in that manner is gratuitous and not binding.

(e) If this solicitation is amended, all terms and conditions that are not amended remain unchanged.

(End of provision)

AOC52.215-3

RESTRICTION ON DISCLOSURE AND USE OF DATA (JUN 2004)

Offerors that include in their proposals data that they do not want disclosed to the public for any purpose, or used by the Government except for evaluation purposes, shall

(a) Mark the title page with the following legend:

This proposal includes data that shall not be disclosed outside the Government and shall not be duplicated, used, or disclosed--in whole or in part--for any purpose other than to evaluate this proposal. If, however, a contract is awarded to this offeror as a result of--or in connection with--the submission of this data, the Government shall have the right to duplicate, use, or disclose the data to the extent provided in the resulting contract. This restriction does not limit the Government's right to use information contained in this data if it is obtained from another source without restriction. The data subject to this restriction are contained in sheets (insert numbers or other identification of sheets) ; and

(b) Mark each sheet of data it wishes to restrict with the following legend:

Use or disclosure of data contained on this sheet is subject to the restriction on the title page of this proposal.

(End of provision)

AOC52.215-7

PREPARATION OF PROPOSALS - CONSTRUCTION (JUN 2004)

(a) Offers shall be submitted, in the quantities as stated elsewhere in this solicitation, on the accompanying printed form entitled, SOLICITATION, OFFER, AND AWARD (Construction, Alteration, or Repair) and copies thereof, with blank spaces suitably filled in. Erasures or other changes on any or all submissions shall be initialed by the signer of the offer.

(b) Copies of the offer shall be identical and each copy shall give the full business address of the offeror, and be signed by him (see Block 20B of the form entitled, SOLICITATION, OFFER, AND AWARD (Construction, Alteration, or Repair) with his usual signature. Offer by partnerships shall furnish the full names of all partners, and shall be signed with the partnership name by one of the members of the partnership or by an authorized representative, followed by the signature and designation of the person signing. Offers by corporations shall be signed with the legal name of the corporation, followed by the name of the State of incorporation and by the signature and designation of the president, secretary, or other person authorized to bind it in the matter. The name of each person signing shall be typed or printed below the signature. An offer by a person who affixes to his signature the word president, Secretary, agent, or other designation, without disclosing his principal, may be held to be the offer of the individual signing. When requested by the Government, satisfactory evidence of the authority of the offer signing in behalf of the corporation shall be furnished.

(End of provision)

AOC52.215-9

FAILURE TO SUBMIT OFFER (JUN 2004)

Recipients of this solicitation not responding with a proposal should not return this solicitation, unless it specifies otherwise. Instead, they should advise the issuing office by letter, postcard, or established electronic commerce methods, whether they want to receive future solicitations for similar requirements. If a recipient does not submit a proposal and does not notify the issuing office that future solicitations are desired, the recipient's name will be removed from the applicable mailing list.

(End of provision)

52.216-1

Type of Contract (Apr 1984)

The Government contemplates award of a Firm Fixed Priced contract resulting from this solicitation.

(End of provision)

AOC52.228-1

OFFER GUARANTEE (JUN 2004)

(a) Failure to furnish an Offer Guarantee in the required form and amount, with and as a part of the proposal, will be cause for rejection of the proposal.

(b) The offeror shall furnish an Offer Guarantee of not less than 20% of the proposed price in the form of a firm commitment consisting of a Bid Bond, Certified Check, Cashier's Check, Irrevocable Letter of Credit, or Postal Money Order made payable to the Architect of the Capitol, or, under Treasury Department Regulations, certain bonds or notes of the United States. The Contracting Officer will return Offer Guarantees, other than Bid Bonds, (1) to unsuccessful offerors as soon as practicable after evaluation of the proposals; and (2) to the successful offeror upon execution of contractual documents and bonds (including any necessary coinsurance or reinsurance agreements), as required by the offer as accepted.

(End of provision)

AOC52.236-13

(f) Enter the Capitol Building through the South visitors entrance on Independence Ave. and obtain a temporary badge. Make your way from the south House end of the building to the North Senate side of the building and you will find Conference Room SB-4 in the Basement. If you run into any problems you can reach Ryan Kirkwood, Contract Specialist at Cell Phone (202) 580-9585.

(g) Bring your own hard hat and safety glasses to use during the walk through.

VISIT TO THE SITE OF THE WORK - CONSTRUCTION (JUN 2004)

(a) It is strongly recommended that all prospective offerors visit the site where the work is to be performed, compare the work requirements with existing conditions, verify dimensions, if necessary, and fully inform themselves regarding the nature and scope of the proposed work and the conditions under which it will be conducted. Offerors shall also inform themselves regarding other work, if any, being done or to be done by or for the United States government, the District of Columbia government and utility companies, by contract or otherwise, where such work may affect or be affected by the operations under the contract. Failure to take these precautions will in no way relieve the successful offeror from his obligation to furnish all materials, services, labor, and any other requirements necessary to complete the work satisfactorily under the conditions established by the contract documents and without additional expense to the Government.

(b) A pre-proposal meeting will be conducted at the U.S. Capitol Building, Room SB-4, Washington, D.C. for all prospective offerors on 03/20/2007 at 9:00am, local time.

(c) The Architect will conduct one field inspection of the work immediately following the pre-proposal meeting. Those intending to participate shall meet at the address above. Information concerning the meeting may be obtained by telephoning Ryan Kirkwood, Contract Specialist at (202) 226-1947.

(d) Offerors are encouraged to submit all questions in writing at least five (5) working days prior to the conference. Questions will be considered at any time prior to or during the conference; however, offerors will be asked to confirm verbal questions in writing.

Subsequent to the conference, an amendment to the solicitation containing an abstract of the questions and answers, and a list of attendees, will be disseminated.

(e) Offerors are cautioned that, notwithstanding any remarks or clarifications given at any site visit, the pre-proposal conference or field inspection, all terms and conditions of the solicitation remain unchanged unless they are changed by amendment to the solicitation. If the answers to conference questions, or any solicitation amendment, create ambiguities, it is the responsibility of the offeror to seek clarification prior to submitting a offer.

(End of provision)

AOC52.215-4

CONTRACT AWARD (JUN 2004)

(a) The Government will evaluate offers in response to this solicitation without discussions and will award a contract to the responsible offeror whose offer, conforming to the solicitation, will be most advantageous to the Government considering only price and the price-related factors specified elsewhere in the solicitation. Therefore, the offeror s initial proposal should contain the offeror s best terms from a price standpoint. The Government reserves the right to conduct discussions.

(b) The Government may

(1) Reject any or all offers;

(2) Accept other than the lowest offer; and

(3) Waive informalities or minor irregularities in offers received.

(c) The Government may accept any item or combination of items, unless doing so is precluded by a restrictive limitation in the solicitation or the offer.

(d) A written award or acceptance of offer mailed or otherwise furnished to the successful offeror within the time for acceptance specified in the offer shall result in a binding contract without further action by either party. Before the offer's specified expiration time, the Government may accept an offer (or part of an offer as provided in Paragraph (c) of this clause), whether or not there are negotiations after its receipt, unless a written notice of withdrawal is received before award. Negotiations conducted after receipt of an offer do not constitute a rejection or counteroffer by the Government.

(e) Neither financial data submitted with an offer, nor representations concerning facilities or financing, will form a part of the resulting contract. However, if the resulting contract contains a clause providing for price reduction for defective cost or pricing data, the contract price will be subject to reduction if cost or pricing data furnished is incomplete, inaccurate, or not current.

(f) The Government may determine that an offer is unacceptable if the prices proposed are materially unbalanced between line items or sub line items. Unbalanced pricing exists when, despite an acceptable total evaluated price, the price of one or more contract line items is significantly overstated or understated as indicated by the application of cost or price analysis techniques. A proposal may be rejected if the Contracting Officer determines that the lack of balance poses an unacceptable risk to the Government.

(End of provision)

VOLUME I I

TECHNICAL

G001	Cover Sheet
AS101	House and Senate - Part Floor Plans
AS102	CVC Generator Vault - Part Floor Plans
M401	House and Senate - Part Floor Plans - Demolition
M402	House and Senate - Part Floor Plans - New Work
M403	CVC Generator Vault - Part Floor Plan
M601	Schedules, Diagrams, Details, Symbols and abbreviations
M701	DDC Sequences and Diagrams
E101	Site Plan - U.S. Capitol Building
E102	Cannon House Office Building, Basement - Equipment Access Route
E401	House and Senate - Part Floor Plans - Demolition
E402	House and Senate - Part Floor Plans - New Work
E403	CVC Generator Vault - Part Floor Plan
E601	Schedules, Diagrams & Symbols List

SECTION 01000 - GENERAL REQUIREMENTS

PART 1 - GENERAL

1.1 DESCRIPTION OF REQUIREMENTS:

- A. **General Requirements:** The provisions or requirements of Division-1 apply to entire work of Contract and, where so indicated, to other elements which are included in project, and include, but are not limited to the following:

1. Summary of the Work.
2. Project Coordination.
3. Definitions and Standards.
4. Schedules and Reports.
5. Submittals.
6. Temporary Facilities and Controls.
7. Products.
8. Project Closeout.

1.2 SUMMARY OF THE WORK:

- A. **Project/Work Identification:**

1. **General:** Project name is Emergency Electrical Service, U.S. Capitol Building, Washington, D.C., as shown on Contract Documents prepared by the Architect of the Capitol (AOC). Drawings and specifications are dated 15 December 2006.
2. **Summary by Reference:** Work of the Contract can be summarized by references to the SCHEDULE, GENERAL CONDITIONS, SUPPLEMENTARY CONDITIONS, Official Procedure for Making Changes in Contracts, Specification Sections, Drawings, Amendments and Modifications to the contract documents issued subsequent to the initial printing of this Project Manual and including, but not necessarily limited to, printed material referenced by any of these.
3. **Abbreviated Written Summary:** Briefly and without force and effect upon the contract documents, the work of the Contract can be summarized as follows:
 - a. Provide a diesel engine generator with wiring and accessories in the existing emergency generator vault located at the Capitol Visitor Center. Generator shall be the fourth generator at this location.
 - b. Provide high-voltage primary feeders into the Senate and House basement level of the Capitol Building extending from the generator vault to new emergency substations at each location.
 - c. Demolish two existing diesel engine generators including associated equipment, piping, wiring and accessories located in the existing Senate and House basement level of the Capitol Building. Salvage generators and designated accessories for the Government.
 - d. Provide temporary emergency power during construction, including on-grade engine generators with wiring and accessories.

- e. Provide miscellaneous architectural and structural demolition and modifications for this installation.
 - f. Provide miscellaneous mechanical demolition and modification, including piping, ventilation equipment, ductwork, controls, wiring and accessories for this installation.
4. **Use of the Contract Documents:** The Contract Documents are comprised of the Drawings (produced by several disciplines), the Specifications, the Amendments, the Contract, approved Changes and other directives. These documents are not to be used separately for bid or construction as they represent the entirety of the project. The Contractor is responsible for ensuring that the documents are used together.
5. **Phasing Plan:** No Phasing Plan is included in the Contract Documents. The Contractor is expected to complete all work sequentially to provide the minimum disruption of parking and normal building operations in the area. The Contractor will provide his own plan for approval by the Government showing proposed sequencing of the work and coordination with Government parking requirements.

B. Contractor Use of Premises:

1. **General:** The Contractor shall limit his use of the premises to the work indicated, so as to allow for the Government's occupancy and use by the public.
2. **Contractor Use of the Existing Building:** During the construction period the site and the building will be occupied by Members of Congress, other Government employees and the general public. Maintain the existing building in a safe and weather-tight condition throughout the construction period. Repair damage caused by construction operations. Take all precautions necessary to protect the building and its occupants during the construction period. Cooperate fully with the Government or his representative during construction operations to minimize conflicts and to facilitate Government usage.
- a. **Clear Passage:** Keep public areas such as hallways, stairs, elevator lobbies and toilet rooms free from accumulation of waste material, rubbish or construction debris. Where tools or debris may fall from overhead, provide covered enclosure.
 - b. **Smoking or open fires** will not be permitted within the building enclosure or on the premises.
 - c. **Temporary Elevator Use:** The Government will designate elevators available for use of Contractor's personnel. Use of other than designated elevators will not be permitted.
3. **Limitations on Use of the Site:** Limitations on site usage as well as specific requirements that impact site utilization are indicated on the Drawings and by other Contract Documents. Portions of the site beyond areas on which work is indicated are not to be disturbed. In addition to these limitations and requirements, administer allocation of available space among entities needing both access and space so as to produce the best overall efficiency in performance of the total work of the project.

Schedule deliveries so as to minimize space and time requirements for storage of materials and equipment on site.

- a. **Unless designated** for sole Contractor use, keep existing driveways and entrances serving the premises clear and available to the Government and its employees at all times. Do not permit trucks of any kind to use existing sidewalks without prior authorization of the Government.
 - b. **Maintain driveways** between and around combustible material storage piles at least 15 feet wide and free of accumulation of rubbish, equipment and materials. Maintain access for fire fighting equipment.
 - c. **Do not unreasonably** encumber the site with materials or equipment. Staging area for equipment and materials will not be provided for the Contractor.
 - d. **Provide 24hr/7day** access to the building by emergency vehicles and firefighting equipment.
 - e. **Hours of work:** Perform work Monday through Friday between 7:00 pm and 7:00 am. See "Noise Control" in paragraph "Temporary Controls" below. No noise is permitted when building is occupied by Congress. Suspend work if necessary.
4. **Construction Parking Control:** Parking space for personal vehicles is not available on the site. Obtain approval of Government for parking of construction motor vehicles or other equipment on the site.
- C. **Government Occupancy:** The Government reserves the right to place and install equipment as necessary in completed areas of the building and to occupy such areas prior to final acceptance, provided that such occupancy does not substantially interfere with completion of the work. Such placing of equipment and partial occupancy shall not constitute acceptance of the work or any part of the work.
- D. **Protection of Government Property:** The Contractor is expected to take all reasonable precautions to protect U.S. Government Property. In the event of damage to or theft of Government Property, the Contractor will be held fully responsible for his own personnel, his subcontractor's personnel and their actions.
- E. **Blasting:** The use of any kind or type of explosive in the performance of the work is prohibited, except the use of construction tools actuated by or employing powder-actuated charges which shall be permitted, provided that the tool is of the kind and design ordinarily used for such construction and that the Government has authorized its use after determining that its use will not endanger human life or safety.
- F. **Mechanical/Electrical Requirements of General Work:** Except as otherwise indicated, comply with applicable provisions of The National Electrical Code (NEC) and standards by National Electrical Manufacturer's Association (NEMA) for electrical components of general work. Where applicable, provide products listed and labeled by nationally recognized independent testing and labeling organizations.

1. Install mechanical and electrical systems and equipment so as to provide ready accessibility for operation and maintenance. For each item of equipment for which lockout/tagout procedures are required, provide access as specified in "Products" under "Installation of Products" below.

1.3 PROJECT COORDINATION:

- A. **Meeting records** and correspondence shall be electronically generated in Word or WordPerfect. Provide a computer disk with all project transactions.
- B. **Coordination and Meetings:** Prepare a written memorandum on required coordination activities. Include such items as required notices, reports and attendance at meetings. Distribute this memorandum to each entity performing work at the project site. Prepare similar memorandum for separate contractors where interfacing of their work is required.
 1. **Continuously coordinate** the work of subcontractors to ensure proper processing and progress of the work. Require each subcontractor to examine work of other trades and all sections of specifications to assure satisfactory installation of, and connection between, his work and work of other trades.
 - a. **Provide other parties**, to the extent their work is affected by this work, all information necessary for the proper execution of their work. Arrange and conduct work so that other parties may complete their work at the site according to schedule. All work under this contract shall be carefully coordinated with work under other such contracts.
 2. **The Contractor** shall maintain a complete set of Contract Documents on the site during the execution of this contract. All Drawings and Specifications shall be posted with the latest information and Changes.
- C. **General Installation Provisions:**
 1. **Comply with the most** current federal OSHA and other safety regulations applicable to the work.
 2. **Pre-Installation Meetings:** Hold a pre-installation meeting at the project site well before installation of each unit of work which requires coordination with other work. Installer and representatives of the manufacturers and fabricators who are involved in or affected by that unit of work, and with its coordination or integration with other work that has preceded or will follow, shall attend this meeting. Advise Government of scheduled meeting dates.
 3. **Installer's Inspection of Conditions:** Require the Installer of each major unit of work to inspect the substrate to receive work and conditions under which the work is to be performed. The Installer shall report all unsatisfactory conditions in writing to the Contractor. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.
 4. **Manufacturer's Instructions:** Where installations include manufactured products, comply with the manufacturer's applicable instructions and recommendations for

- installation, to the extent that these instructions and recommendations are more explicit or more stringent than requirements indicated in the Contract Documents.
5. **Mounting Heights:** Where mounting heights are not indicated, mount individual units of work at industry recognized standard mounting heights for the particular application indicated. Refer questionable mounting height choices to the Government for final decision.
 - a. **Mount units of work** required to be accessible to handicapped people at heights prescribed by the Uniform Federal Accessibility Standards as referenced by the Americans with Disabilities Act (ADA) (Fed. Reg./Vol. 56, No. 144/Part 36).
- D. **Cleaning and Protection:** During handling and installation of work at the project site, clean and protect work in progress and adjoining work on the basis of continuous maintenance. Apply protective covering on installed work where it is required to ensure freedom from damage or deterioration at time of completion.
1. **Clean and perform maintenance** on installed work as frequently as necessary through remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
 2. **Limiting Exposures of Work:** To the extent possible through reasonable control and protection methods, supervise performance of the work in such a manner and by such means which will ensure that none of the work, whether completed or in progress, will be subjected to harmful, dangerous, damaging or otherwise deleterious exposure during the construction period.
 - a. **Protect against possible damage** all sills, jambs and soffits of permanent openings used as passageways or through which materials are handled. Protect exposed corners, spandrels, projecting features and similar permanent work subject to damage. Cover and protect all prefinished work from damage by mortar, plaster, gypsum drywall compounds, paint, and other construction materials and operations. Use wheelbarrows equipped with rubber tires over permanently exposed floors and paving. Provide special protection for works of art, as prescribed in the Contract Documents.
 3. **Load all trucks** leaving the site with earthen materials or loose debris in a manner that will prevent dropping of materials on streets. Fasten suitable tarpaulins over the load before they enter surrounding paved streets. Trucks bringing earthen materials over paved streets to the site shall be similarly covered.
 4. **Clean sidewalks and streets** adjacent to site daily or more often as necessary, of debris spillage or mud/dirt tracked from loading and trucking involved in construction operations. Maintain suitable truck wheel washing installation and crew to prevent any mud from being carried onto adjacent paved streets. Conform to local regulations regarding load limits.
- E. **Cutting and Patching:** Where the Contractor must cut, patch, alter, add to, repair or refinish existing construction and finishes which are not to be removed, he shall leave such

construction and finishes complete and in satisfactory condition. Cutting, patching, and the like shall be neatly and carefully performed, and new materials and methods shall match existing corresponding work unless otherwise indicated. Exposed patches and repairs shall be as inconspicuous as possible.

1. **Construction, finishes,** equipment and other items which are damaged or defaced by reason of work performed under this contract shall be restored to the satisfaction of the Government.
 2. **Structural elements:** Foundation construction, bearing walls, structural concrete, structural steel, structural deck, lintels, miscellaneous structural metals, stairs, equipment supports, piping, ductwork, vessels and equipment, structural elements of other construction.
 - a. Do not cut or patch in a manner that would reduce load-carrying capacity or load-deflection ratio.
 - b. Notify Architect of proposed cutting and patching procedures, and obtain written approval, before proceeding.
- F. **Conservation and Salvage:** It is a requirement for supervision and administration of the work that construction operations be carried out with the maximum possible consideration given to the conservation of energy, water and materials. In addition, maximum consideration shall be given to salvaging materials and equipment involved in performance of the work but not incorporated therein. The existing generators, to be removed by the Contractor, shall be properly prepared for long term storage and transported to Fort Meade by the Contractor.
1. **Architect Notification:** To allow time for the Architect to observe the construction, provide a minimum of 48 hours notice of excavation work, completion of steel reinforcing, pouring of concrete, paving operations, utility work, trenching, tree removal or replacement, commencements of next phase of work, and other tasks to be identified by the Government.
 2. **Archaeological Rights:** There is a possibility that items of archaeological significance may be found during the excavation of the site. In such event, the Contractor shall stop excavation in the vicinity of the find and notify the Architect immediately; subsequent excavation work shall proceed as directed by the Architect. All items found which are considered to have archaeological significance are the property of the Government.

1.4 DEFINITIONS AND STANDARDS:

- A. **General:** Comply with governing regulations and the codes and standards imposed upon the work. These requirements include the obtaining of permits, licenses, inspections, releases and similar documentation, as well as payments, statements and similar requirements associated with regulations, codes and standards.
- B. **Definitions:** A substantial amount of specification language consists of definitions for terms found in other contract documents, including the drawings. (Drawings must be recognized as diagrammatic in nature and not completely descriptive of the requirements

indicated thereon). Certain terms used in contract documents are defined in this article. Definitions and explanations contained in this section are not necessarily either complete or exclusive, but are general for the work to the extent that they are not stated more explicitly in another element of the contract documents.

1. **Installer:** The term "installer" is defined as the entity (person or firm) engaged by the Contractor, its subcontractor or sub-subcontractor for performance of a particular unit of work at the project site, including installation, erection, application and similar required operations. It is a general requirement that such entities (installers) be expert in the operations they are engaged to perform.
2. **Testing Laboratory:** The term "testing laboratory" is defined as an independent entity engaged to perform specific inspections or tests of the work, either at the project site or elsewhere, and to report, and (if required) interpret results of those inspections or tests.
3. **Indicated:** The term "indicated" is a cross-reference to graphic representations, notes or schedules on drawings, to other paragraphs or schedules in the specifications, and to similar means of recording requirements in contract documents. Where terms such as "shown," "noted," "scheduled," and "specified" are used in lieu of "indicated," it is for the purpose of helping the reader locate cross-reference, and no limitation is intended except as specifically noted.
4. **Furnish:** Except as otherwise defined in greater detail, the term "furnish" is used to mean supply and deliver to the project site, ready for unloading, unpacking, assembly, installation, etc., as applicable in each instance.
5. **Install:** Except as otherwise defined in greater detail, the term "install" is used to describe operations at the project site including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning and similar operations, as applicable in each instance.
6. **Provide:** Except as otherwise defined in greater detail, the term "provide" means furnish and install, complete and ready for intended use, as applicable in each instance.
7. **Exposed:** The term "exposed" is defined as an item or surface, exterior or interior, which can be seen by a person outside the building or a person inside a usable space within the building during normal activity.
 - a. Mechanical and electrical rooms, air handling rooms, storage rooms and penthouses shall be considered to have exposed surfaces, as shall the mechanical and electrical construction within them.
 - b. The interiors of closets and alcoves shall be considered exposed surfaces, and shall be finished to match the finish of the adjoining room or space, unless another finish is otherwise indicated.
 - c. The interiors of cabinets shall be considered exposed, but a finish different from that of the exterior may be permitted or required by other sections.
8. **Concealed:** The term "concealed" is defined as an item or space not normally seen, occupied or used by building occupants or staff, such as shafts, hoistways, tunnels, ceiling plenums, attics, and crawls spaces.
9. **Finished Space:** The term "finished space" is defined as space normally used by the public, building occupants or staff for primary functions of the building, but

does not include mechanical, electrical and elevator equipment rooms, hoistways, tunnels or mechanical penthouses, unless otherwise indicated.

10. **Specialist:** The term "specialist" is defined as an individual or firm of established reputation (or, if newly organized, whose personnel have previously established a reputation in the same field), which is regularly engaged in, and which maintains a regular force of workers skilled in either (as applicable) manufacturing or fabricating items required by the contract, installing items required by the contract, or otherwise performing work required by the contract. Where the contract specification requires installation by a specialist, that term shall also be deemed to mean either the manufacturer of the item, an individual or firm licensed by the manufacturer, or an individual or firm who will perform the work under the manufacturer's direct supervision.

- C. **Format and Specification Content Explanations:** Bolding and underscoring: Are used strictly to assist reader of specification text in scanning text for key words (for quick recall). No emphasis on or relative importance is intended where bolding and underscoring are used. Imperative language is used generally in specifications. Except as otherwise indicated, requirements expressed imperatively are to be performed by the Contractor. For clarity of reading at certain locations, contrasting subjective language is used to describe responsibilities which must be fulfilled indirectly by Contractor, or when so noted, by others.

1. **Abbreviations:** The language of specifications and other contract documents is of the abbreviated type in certain instances, and implies words and meanings which will be appropriately interpreted. Actual word abbreviations of a self-explanatory nature have been included in texts. Specific abbreviations have been established, principally for lengthy technical terminology and primarily in conjunction with coordination of specification requirements with titles of general standards which are frequently abbreviated. Singular words will be interpreted as plural and plural words will be interpreted as singular where applicable and where full context of the contract documents so indicates.
2. **Minimum Quality/Quantity:** In every instance, the quality level or quantity shown or specified is intended as minimum for the work to be performed or provided. Except as otherwise specifically indicated, actual work may either comply exactly with that minimum (within specified tolerances), or may surpass the quality of that minimum within reasonable limits. In complying with requirements, indicated numeric values are either minimum or maximums as noted or as appropriate for context of requirements. Refer instances of uncertainty to the Government for decision before proceeding.

- D. **Overlapping and Conflicting Requirements:** Where there appears to be overlapping or conflicting requirements in the drawings and specifications, refer all such questions in writing to the Government for interpretation. Do not proceed with that portion of the work that is under question until the Government has replied in writing. Delays necessitated by requests for interpretation shall not form the basis for a Change to the contract. The Government's interpretation and decision shall be final. Procedures for resolving disagreements with the decision of the Government are outlined in the General Conditions of the Contract. The order of precedence is established as follows:

1. **Order of Precedence:** Any inconsistency in this solicitation or Contract shall be resolved by giving precedence in the following order:
 - a. The Schedule (excluding the specifications).
 - b. Representations and other instructions.
 - c. Contract clauses.
 - d. The Specifications.
 - e. The Drawings. Large scale drawings take precedence over small scale drawings. Do not scale drawings.
 2. **Industry Standards:** Where compliance with two (2) or more industry standards or sets of requirements is specified, and overlapping of those different standards or requirements establishes different or conflicting minimums or levels of quality, the most stringent requirement is intended and will be enforced, unless specifically detailed language written into contract documents clearly indicates that a less stringent requirement is to be fulfilled. Refer apparently-equal-but-different requirements, and uncertainties as to which level of quality is more stringent, to the Government for a decision before proceeding.
 3. **Contractor's Options:** Except for overlapping or conflicting requirements, where more than one set of requirements are specified for a particular unit of work, Options are intended to be the Contractor's regardless of whether or not it is specifically indicated as such.
- E. **Drawing Symbols:** Except as otherwise indicated, graphic symbols used on drawings are those symbols recognized in the construction industry for purposes indicated. Where not otherwise noted, symbols are defined by "Architectural Graphic Standards", published by John Wiley & Sons, Inc., Ninth edition.
1. **Mechanical/Electrical Drawings:** Graphic symbols used on mechanical and electrical drawings are generally aligned with symbols recommended by ASHRAE. Where appropriate, these symbols are supplemented by more specific symbols as recommended by other recognized technical associations including ASME, ASPE, IEEE and similar organizations. Refer instances of uncertainty to the Government for clarification before proceeding.
- F. **Industry Standards:** Except to the extent that more explicit or more stringent requirements are written directly into contract documents, applicable standards of the construction industry have the same force and effect (and are made a part of the contract documents by reference) as if copied directly into the contract documents, or as if published copies were bound herein, subject to the order of precedence previously stated.
1. **Publication Dates:** Except as otherwise indicated, where compliance with an industry standard is required, conform to the standard in effect on the date of the Invitation for Bids, or, if referred to in any Amendments, at the date of such Amendments.
 2. **Abbreviations and Names:** The following acronyms or abbreviations as referenced in contract documents are defined to mean the associated names. Both

names and addresses are subject to change, and are believed to be, but are not assured to be, accurate and up-to-date as of the date of contract documents:

ANSI	American National Standards Institute www.ansi.org	(202) 293-8020
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers www.ashrae.org	(800) 527-4723 (404) 636-8400
ASTM	ASTM International (American Society for Testing and Materials International) www.astm.org	(610) 832-9585
IEEE	Institute of Electrical and Electronics Engineers www.ieee.org	(212) 419-7900
NECA	National Electrical Contractors Association www.necanet.org	(301) 657-3110
NEMA	National Electrical Manufacturers Association www.nema.org	(703) 841-3200
NFPA	National Fire Protection Association www.nfpa.org	(800) 344-3555 (617) 770-3000
UL	Underwriters Laboratories Inc. www.ul.com	(800) 704-4050 (847) 272-8800

- G. **Federal Government Agencies:** Names and titles of federal government Standard- or Specification-producing agencies are often abbreviated. The following acronyms or abbreviations referenced in the Contract Documents indicate names of Standard- or Specification-producing agencies of the federal government. Names and addresses are subject to change but are believed to be, but are not assured to be, accurate and up to date as of the date of the Contract Documents.

CFR	Code of Federal Regulations Available from Government Printing Office www.access.gpo.gov/nara/cfr	(888) 293-6498 (202) 512-1530
EPA	Environmental Protection Agency www.epa.gov	(800) 438-2474
FS	Federal Specification Available from Defense Automated Printing Service www.astimage.daps.dla.mil/online	(215) 697-6257

Available from General Services Administration (202) 619-8925
www.fss.gsa.gov/pub/fed-specs.cfm

Available from National Institute of Building Sciences (202) 289-7800
www.nibs.org

OSHA Occupational Safety and Health Administration (800) 321-OSHA
www.osha.gov (6742)

- H. **District of Columbia Government Agencies:** Names and titles of local government Standard- or Specification-producing agencies are often abbreviated. The following acronyms or abbreviations referenced in the Contract Documents indicate names of Standard-or Specification-producing agencies of the DC government. Names and addresses are subject to change but are believed to be, but are not assured to be, accurate and up to date as of the date of the Contract Documents.

DC-EHA Environmental Health Administration (202) 535-2500
 Department of Health
 Government of the District of Columbia
 51 N Street, N.E, Room 5030-B
 Washington, DC 20002
dchealth.dc.gov

DDOT District Department of Transportation (202) 673-6813
 2000 14th Street, NW, 6th Floor
 Washington, DC 20009
ddot.dc.gov

WASA District of Columbia Water and Sewer Authority (202) 787-2427
 5000 Overlook Avenue, S. W.
 Washington, DC 20032
www.dcwasa.com

1.5 SCHEDULES & REPORTS:

- A. **Meeting records** shall be electronically generated in Word or WordPerfect. Schedules shall be generated in Excel spreadsheets. Provide a computer disk with all project transactions.
- B. **Coordination:** Coordinate both the listing and timing of reports and other activities required by provisions of this and other sections, so as to provide consistency and logical coordination between the reports. Maintain coordination and correlation between separate reports by updating at monthly or shorter time intervals. Make appropriate distribution of each report and updated report to all parties involved in the work including the Government.
- C. **Material Schedule:** Prior to commencing work, submit for approval the names of manufacturers and the trade names or numbers of all materials proposed for use on the

project. Do not use any material until approved by the Government. Upon request, furnish samples of materials, without cost to the Government, for examination and testing.

1. **Submit 3 copies** of the product-listing schedule prior to commencement of the Work. Provide a written explanation for omissions of data, and for known variations from contract requirements.
- D. **Schedule of Values:** Within thirty (30) calendar days of the date of contract award, a Schedule of Values shall be submitted. This schedule is defined as a work item by work item breakdown of cost of each definitive work activity including Contractor's markup. The Schedule of Values shall directly correlate with the Phases of Work indicated on the approved Progress Schedule specified below.
1. The Grand Total of all of the Schedules shall equal Contractor's original bid.
 2. The proper updating of both the Schedule of Values and the Record Drawings shall be considered precedent to approval of Partial Payments.
- E. **Shop Drawing Submittal Schedule:** Within thirty (30) calendar days of the date of contract award, a Shop Drawing Submittal Schedule shall be submitted. The schedule shall indicate at a minimum, all shop drawing submittals to be made, their contents, each specification section the submittal is drawn from, the date on which it will be submitted, the expected return dates, and the subcontractor responsible for creating the submittal. The submittal will be reviewed by the Government as the first shop drawing submittal and comments made must be acknowledged and employed in the resubmission prior to the submittal of any other shop drawing. Do not "Load" the schedule.
- F. **Fully-Developed Progress:** Within 60 days of the date of Contract Award, the Contractor shall prepare and submit for approval a comprehensive bar-chart type progress schedule indicating, by stage-coded symbols, a time bar for each major category or unit of work to be performed at the site; include minor elements of work which are, nevertheless, involved in overall sequencing of the work. Arrange the schedule to show how final acceptance is scheduled to allow for the Architect's procedure for certification of final acceptance. Prepare the schedule on sheets of stable transparency, or other reproducible material, to permit reproduction for the required distribution.
1. **Cost Correlation:** Immediately below the date line at the heading of the bar-chart, provide a two item cost correlation line, indicating both "precalculated" and "actual" costs. This cost correlation line shall show dollar-volume of work performed as of the same dates used for preparation of partial payment requests. Refer to GENERAL CONDITIONS for cost reporting and payment procedures. In so far as it is practical to do so, use the same units of work in the progress schedule as indicated in the "schedule of values" required by the GENERAL CONDITIONS and further specified above.
 2. **Schedule Updating:** Following its initial approval, the project schedule shall be updated monthly for the purpose of recording and monitoring progress of the Work and establishing the values of progress payments. If the Work falls behind schedule, revise schedule and describe action to be taken to insure that work will be completed within the Contract time. Any adjustment to the Contract Time shall

be made in accordance with GENERAL CONDITIONS. For each schedule update, prepare a narrative report which shall include a description of all activities completed during the preceding month, description of progress made and planned activities listed as started but not completed on the updated Progress Schedule, and a written description and justifications of any proposed revision to the logic sequence.

- a. **Contractor Revisions:** The Contractor may also request revisions to the logic sequence and schedule of the Progress Schedule in the event that his planning for the project is revised. If revisions to the approved Progress Schedule are desired, the Architect shall be notified in writing for his approval, stating reasons for proposed revisions. If the Architect considers such proposed revisions to be of a major nature, he may require the Contractor to revise and resubmit for approval, without additional cost to the Government, all or the affected portion of the schedule to indicate the effect on the entire project. Provide two weeks notice to the Architect, in writing, prior to submitting any Contractor proposed revisions not discussed in previous Progress Meeting.
- b. **Architect Revisions:** Architect-directed revisions to the Progress Schedule will be forwarded to the Contractor with a ten (10) calendar day Contractor response period. The Contractor shall either assent to the proposed change or state reasons for not implementing the proposed revision.
- c. **Progress Updates:** Revisions to the Progress Schedule made to reflect actual work progress to date are not revisions to logic sequence and schedule. In disagreements concerning actual progress recorded to date, the Architect's determination shall govern.

3. **Distribution:** Following the initial submittal to and response by the Architect, print and distribute progress schedules to the Architect (4 copies), separate contractors, the principal subcontractors and suppliers or fabricators, and others with a need-to-know schedule-compliance requirement. When revisions are made, distribute updated issues to the appropriate entities.

- G. **Progress Meetings and Documentation:** In addition to specific coordination and pre-installation meetings for each element of work, and other regular project meetings held for other purposes, hold a general progress meeting each month with time coordinated with preparation of the partial payment request. Require each entity then involved in planning, coordination or performance of work to be properly represented at each meeting. Discuss status of each element of current work in relation to Progress Schedule. Determine how behind-schedule work will be expedited, and secure commitments from entities involved in doing so to ensure that work will be completed within Contract Time.

1. **Initial Progress Meeting:** Schedule initial progress meeting, recognized as "Pre-Construction Meeting", for a date not more than 15 days after date of commencement of the Work. Use it as an organizational meeting, and review responsibilities and personnel assignments.
2. **Daily Reports:** Prepare a daily report, recording information concerning events at the site; and submit duplicate copies to Government on at least weekly intervals.

- H. **Permits, Licenses, and Certificates:** For the Government's records, submit copies of utility permits, licenses, certifications, utility inspection reports, releases, notices, receipts for fee payments, judgments, and similar documents, correspondence and records established in conjunction with compliance with standards and regulations bearing upon performance of the Work.

1. Utility permits include the Permit to Construct/Operate Internal Combustion Engine, required for the new generator by the District of Columbia Air Quality Division. When applying for the new permit, refer to previous applications and coordinate requirements for the facility.

1.6 SUBMITTALS:

- A. **General:** Shop drawings, product data, samples and other work-related submittals are required to amplify, expand and coordinate the information contained in the Contract Documents. The Contractor is responsible for all dimensions, for the design of adequate or proper components, connections and other items, for the inclusion in the work of all elements and incidental details, and for the satisfactory fabrication, construction, operation and coordination of the work.

1. **Approval** of any submission shall not be construed as a complete or precise check of the item submitted but will only indicate that the general methods of design, detailing, construction or other elements under consideration appear to be satisfactory, without specific determinations or particulars.
2. **Changes to the Contract** will not be made by notations on submittals. In the event submittals returned by the Government with notations, which in the opinion of the Contractor, constitute additional work for which he is entitled to an adjustment in the contract sum or the contract time, the Contractor shall comply with the procedure set forth in Article, "Changes," of the GENERAL CONDITIONS.
3. **Do not permit** submittal copies without an appropriate final "Action" marking by the Government to be used in connection with the work.
4. **Submissions of "Approved Equals:"** In addition to standard submittal requirements, for each item submitted as an "approved equal" submit the following:
 - a. **Comparison of** proposed approved equal's characteristics with the salient characteristics of the specified product demonstrating that the proposed approved equal fully meets or exceeds the specifications,
 - b. **Drawings and** samples as required for specified products,
 - c. **Any changes** required in other elements (if any) because of the submission of the proposed approved equal, and
 - d. **A listing of** sources of supply, maintenance service (if applicable), and replacement parts.

- B. **Submittal Procedures:** Make all submittals to the Government or to an individual designated by the Government.

1. **Only the Government** or an individual designated by the Government can approve or disapprove submittals. Deviations and variations from the contract requirements

- contained in the submittal can be approved only by the Government or by an individual delegated such authority by the Government.
2. **Costs** associated with transmittal of submittals shall be borne by the Contractor.
 3. **Review Time:** Except as specified elsewhere, allow for a review period of thirty (30) calendar days after receipt of the submittals by the Government. Advise the Government on each submittal, as to whether processing time is critical to the progress of the work, and if work would be expedited if processing time could be shortened. No extension of time will be authorized because of the Contractor's failure to transmit submittals or re-submittals to the Government sufficiently in advance of the work. For submittals of items requiring coordination between different trades or subcontractors, review time period starts from the time that all required submittals have been received by the Government and ends when submittal leaves the Government. The Contractor is required to coordinate all work involving associated sub-trades and produce coordinated drawings for submittal where required by individual specification sections or as required below.
 4. **Preparation of Submittals:** Provide permanent marking on each submittal to identify project, date, Contractor, subcontractor, supplier, manufacturer, submittal name and similar information to distinguish it from other submittals. Label as to number and title of specification section, drawing number and detail references, as appropriate. Show Contractor's executed review and approval marking and provide space of not less than 20 sq. in. for the Government's "Action" marking. Package each submittal appropriately for transmittal and handling. Submittals which are received from sources other than through the Contractor's office will be returned without action.
 5. **Number of Copies:** Submit a minimum of four (4) copies of each submittal requested.
- C. **Specific Submittal Requirements:** Specific submittal requirements for individual units of work are specified in the applicable specification section. Except as otherwise indicated in the individual specification sections, comply with the requirements specified herein for each type of transmittal.
1. **Product Data:** Collect required product data into a single submittal for each unit of work or system. Mark each copy to show which choices and options are applicable to the project. Where product data has been printed to include information on several similar products, some of which are not required for use on the project, or are not included in this submittal, mark the copies to show clearly that such information is not applicable.
 - a. **Submittals:** Submittal is for information and record, unless otherwise indicated. Initial submittal is final submittal unless returned by the Government, marked with an action which indicates an observed non-compliance.
 - 1) **Initial Submittal:** Except as otherwise indicated, submit four (4) copies of each required product data submittal, plus two (2) additional copies where required for maintenance manuals. The

Government will retain two (2) copies and return the other marked with "Action" and corrections or modifications as required.

2. **Shop Drawings:** Provide special notation of dimensions that have been established by field measurement. Highlight, encircle or otherwise indicate deviations from the Contract Documents on the shop drawings.
 - a. **Preparation:** Submit newly prepared information, drawn to accurate scale on sheets not less than 8-1/2" x 11"; except for actual pattern or template type drawings, the maximum sheet size shall not exceed 36" x 48". Indicate the name of the firm that prepared each shop drawing and provide appropriate project identification in the title block.
 - 1) Do not reproduce contract documents or copy standard printed information as the basis of shop drawings.
 - 2) Use standard Architectural scales for all drawings..
 - b. **Coordination Drawings:** Prior to installation of sleeves and inserts for equipment, and/or the performance of work in spaces in which two or more trades are involved and in which the probability of interference exists as determined by either the Contractor or the Government, submit composite coordination drawings for the Work. Show sequencing and relationship of separate units of work which must interface in a restricted manner to fit in the space provided, or function as indicated. In case interference develops, the Government will decide which work shall be relocated, regardless of which was installed first. Coordination drawings are considered shop drawings and must be definitive in nature.
 - 1) Where system or equipment are required to be arranged to provide access for operation, service, or maintenance, submit coordination drawings showing that such arrangement also provides easy access for Architect's lockout/tagout procedures.
 - c. **Equipment and Systems:** Shop Drawings for equipment and systems shall show ratings (where applicable), and how components are assembled, function together, and how they will be installed. Shop drawings, product data, certificate of conformance or compliance, certified test or inspection reports, and other submittals for equipment, systems, and their component parts shall be coordinated and submitted as a unit. Multiple or piecemeal submissions are not acceptable except where prior approval is obtained from the Government, in which case a list of data to be submitted later shall be included with the first submission.
 - d. **Initial Submittals:** Original transmittal letter and 2 blue-line or black-line prints shall be forwarded to Government for approval. Copy of transmittal letter, 1 blue-line or black-line print and one correctable 1-1/2 mil translucent polyester reproducible of each shop drawing shall be forwarded to the entity designated as specified in "Submittal Procedures" above.

- e. **Final Submittal:** 3 prints, plus 2 additional prints where required for maintenance manuals; 2 will be retained and remainder will be returned, one of which is to be marked-up and maintained by Contractor as "Record Document."
- 3. **Material Safety Data Sheets (MSDS):** Submit information directly to Architect's Safety Officer; do not submit as action or informational submittal.
 - a. **Architect** will not review Submittals that include MSDS and will return the entire Submittal for resubmittal.
- 4. **Samples:** Documentation required specifically for sample submittals includes a generic description of the sample, the sample source or the product name or manufacturer, compliance with governing regulations and recognized standards. In addition, indicate limitations in availability, sizes, delivery time, and similar limiting characteristics.
 - a. **Preparation:** Where possible provide samples that are physically identical with the proposed material or product to be incorporated in the work; provide full scale, fully fabricated samples cured and finished in the manner specified. Where variations in color, pattern, or texture are inherent in the material or product represented by the sample, submit not less than 3 units of the sample, which show the full range of variations. Where samples are specified for the Government's selection of color, texture or pattern, submit a full set of available choices for the material or product. Mount, display, or package samples in the manner specified to facilitate the review of indicated qualities. Prepare samples to match the Government's sample where so indicated.
 - b. **Submittal:** Submit 3 sets of samples in the final submittal, one set will be returned. If the submittal is for the Government's selection of color, pattern, texture or similar characteristics from a manufacturer's standard range of choices, only a single set of samples is required for a preliminary submittal. The final submittal may then be limited only to those choices selected by the Government for final incorporation into the Work.
- 5. **Miscellaneous Submittals:**
 - a. **Inspection and Test Reports:** Classify each inspection and test report as being either "shop drawings" or "product data" depending on whether the report is specially prepared for the project, or a standard publication of workmanship control testing at the point of production. Process inspection and test reports accordingly.
 - b. **Offsite Fabrication Facilities:** Provide for scheduled visits to off site fabrication facilities by the Government. Make all facilities, including storage areas and plant, open and accessible to review of procedures, materials used and storage and shipping methods.
 - c. **Warranties:** Refer to Article "Products" for specific general requirements on warranties, product bonds, workmanship bonds and maintenance

- agreements. In addition to copies desired for the Contractor's use, furnish 2 executed copies of such warranties, bonds or agreements. Provide 2 additional copies where required for maintenance manuals.
- d. **Staging Plan:** There will be no staging area available. The Government has indicated in plan where the Contractor can stage the construction. Submit a Staging Plan indicating specific locations of the superintendent's trailer, storage and loading of materials, traffic direction and control concept and signage, security perimeter for staging area, locations of informational construction signage, locations of temporary toilets and other temporary construction, emergency facilities and resources and any other construction facilities required.
 - e. **Traffic Control:** Submit a site plan and details for review and approval by the Government to diagrammatically indicate proposed measures for safely and efficiently controlling and re-routing traffic as necessary to enable construction work, deliveries, testing operations and other activities. Indicate schedules of activities occurring hourly before, during and after the normal workday. At all times provide minimal disruption to the day-to-day activities occurring on the site and at adjacent locations.
 - f. **Safety Plan:** Provide as specified in Division 01 Section "Safety and Health."
6. **Closeout Submittals:** Refer to Article "Project Closeout" and to individual sections of these specifications for specific submittal requirements of project closeout information, materials, tools, and similar items.
- D. **Government's Action:** Except for submittals for the record and similar purposes, where action and return on submittals is required or requested, the Government will review each submittal and mark with appropriate "Action." Where the submittal must be held for coordination, the Government will so advise the Contractor without delay.
- 1. **If no changes** to the drawing are required, three (3) prints and the reproducible drawing will be returned to the Contractor, bearing the stamp of the Government, stating - "APPROVED."
 - 2. **If changes** to the drawing are required, but are of such minor nature that fabrication and/or construction can proceed in accordance with the correction noted by the Government without resubmission of the drawing three (3) prints and the reproducible drawing will be returned to the Contractor bearing the Stamp of the Government stating "Approved as Noted." The Contractor shall proceed with fabrication and/or construction in accordance with the Government's corrections, and resubmit corrected copy for the Government's records.
 - 3. **If changes** to the drawing are required, but are of such nature that fabrication or construction cannot proceed, three (3) prints and the reproducible drawing will be returned to the Contractor, bearing the stamp of the Government stating - "Revise and Resubmit." In such a case, the Contractor shall resubmit the drawings, properly corrected. Upon resubmission of shop drawings, if any corrections or changes are made other than those marked by the Government, the Contractor shall clearly indicate any such corrections or changes made on his own initiative.
 - 4. **If the product does not meet** the specification requirements, the number of copies outlined above will be returned to the Contractor, bearing the stamp of the

Government stating - "REJECTED." In such a case, the Contractor shall submit a new product which complies with the technical specifications.

5. **Other Action:** Where the submittal is returned, marked with the Government's explanation, for special processing or other Contractor activity, or is primarily for information or record purposes, the submittal will be marked as follows:
 - a. **Not Subject to Review:** This review category will apply to submittals which are not required by the Contract Documents and are inadvertently submitted and stamped; or
 - b. **Received/No Action Required:** This category will be used when returning "Informational Submittals" for which the Government is not required to take action.

1.7 TEMPORARY FACILITIES AND CONTROLS:

- A. **Description of Requirements:** This article specifies administrative and procedural requirements for temporary services and facilities, including such items as temporary utility services, temporary construction and support facilities, and project security and protection.
 1. **Use Charges:** No cost or usage charges for temporary services or facilities are chargeable to the Government. Cost or use charges for temporary services or facilities will not be accepted as a basis of claims for a change-order extra. All materials and equipment provided by the Contractor for temporary facilities shall remain the property of the Contractor.
 2. **Materials and Execution:** Provide new materials and equipment for temporary services and facilities; used materials and equipment that are undamaged and in serviceable condition may be used, if acceptable to the Government. Provide only materials and equipment that are recognized as being suitable for the intended use, by compliance with appropriate standards. Do not use materials of temporary service in permanent installation.
- B. **Quality Assurance:** Comply with the requirements of the District of Columbia Building Code and regulations governing construction and local industry standards, in the installation and maintenance of temporary services and facilities.
 1. **Standards:** Comply with the requirements of NFPA Code 241, "Building Construction and Demolition Operations"; the ANSI-A10 Series standards for "Safety Requirements for Construction and Demolition"; the NECA National Joint Guideline NJC-6 "Temporary Job Utilities and Services"; and the most current versions of federal OSHA and other safety regulations applicable to the project.
 - a. **Refer** to "Guidelines for Bid Conditions for Temporary Job Utilities and Services", as prepared jointly by Associated General Contractors of America (AGC) and American Specialty Contractors, Inc. (ASC) for industry recommendations.
 - b. **Trade Jurisdictions:** The assigned responsibilities for the installation and operation of temporary utilities are not intended to interfere with the

normal application of trade regulations and union jurisdictions applicable to the work.

2. **Inspections:** Inspect and test each service before placing temporary utilities in use. Arrange for required inspections and tests by governing authorities, and obtain required certifications and permits for use.
- C. **Job Conditions:** Provide each temporary service and facility ready for use at each location when the service or facility is first needed to avoid delay in performance of the Work. Maintain, expand as required and modify temporary services and facilities as needed throughout the progress of the Work. Do not remove until services or facilities are no longer needed, or are replaced by the authorized use of completed permanent facilities.
- D. **Temporary Utilities:** The Government will designate a connection point for installation of temporary service to the project to existing service. Arrange with the Government for an acceptable time when service can be interrupted, where necessary to make connections for temporary services.
 1. **Temporary Electric Power Service:** Electrical energy will be supplied by the Government, but the Contractor shall install and maintain all necessary conduit, wiring, and devices needed to execute the work. Install all wiring in flexible conduit or armored cable with minimum No. 12 gage wire. Portable cords for small power tools shall be properly grounded and installed as approved by the Government. Provide receptacle outlets equipped with ground-fault circuit interrupters, reset button and pilot light, for plug-in connection of power tools and equipment. The Government will not be held responsible for power outages beyond its control.
 - a. **Comply with applicable NEMA, NECA and UL standards** and governing regulations for materials and layout of temporary electric service, including those requirements included in Division-16 sections.
 - b. **Install service and grounding** in compliance with the National Electric Code (NFPA 70), District of Columbia Building Code, and Power Company requirements. Include necessary service connection, service switch, meters, transformers, overload protected disconnect, main distribution switch gear, panelboards, wiring, cables, devices, and accessories.
 2. **Temporary Lighting:** Provide local switching of temporary lighting, spaced to allow lighting to be turned off in patterns to conserve energy and retain light suitable for work-in-progress, access traffic, security check and project lock-up.
 - a. **Provide general service incandescent lamps** of wattage indicated or required for adequate illumination. Protect lamps with guard cages or tempered glass enclosures, where fixtures are exposed to breakage by construction operations. Provide exterior fixtures where fixtures are exposed to weather or moisture. Keep sockets equipped with active lamps. Where feasible, utilize fluorescent type fixtures.

3. **Temporary Heating, Cooling and Ventilating:** Provide temporary heating, cooling, and ventilating where indicated or needed for performance of the Work, curing or drying of recently installed work or for protection of work in place from adverse effects of low temperatures or high humidity. Select facilities known to be safe and without deleterious effect upon the work in place or being installed. Coordinate with ventilation requirements to produce the indicated ambient condition required, to minimize the consumption of fuel or energy, and to comply with code requirements.
 - a. **Maintain** a minimum temperature of 50 deg. F (7 deg. C) in permanently enclosed portions of the building and areas where finished work has been installed. Provide temporary heating units that have been tested and labeled by UL, FM or another recognized trade association related to the fuel being consumed. Do not use open burning or salamander type heating units where prohibited by governing codes or regulations, or when combustible materials are located in or near the space being heated, or when the work installed or being installed includes work which will be exposed to view in the completed project.
 - 1) **Do not store** fuel in building.
 - b. **Provide for ventilation** requirements where possible through use of natural ventilation, utilizing temporary heat and enclosures and openings to effect needed movement of air. Where necessary, install temporary fans or blowers to provide ventilation of construction spaces. Where necessary, operate units with filters and baffles to avoid distribution of dust and fumes and to minimize deleterious effects upon work. Equip portable ventilating fans with suitable safety guards.
 - c. **As soon as practical**, after permanent system is in place and operable, provide heat from the permanent building heating system, under operation and supervision of personnel authorized by the equipment manufacturer, until the building is complete.
 1. Permanent system may be operated without diffusers and registers in place, but filters with same efficiency as those specified for permanent system must be installed in ductwork.
 2. Immediately prior to acceptance by the Government, clean ducts and replace all used filters with new ones.
4. **Temporary Telephones:** Arrange for the local telephone company to install temporary service to the project or provide cellular service to the contractor's site superintendent.. Location of telephones and telephone wires is subject to Government's approval.
5. **Water Service:** Water will be provided for project use by the Government at existing sources. Provide temporary piping, connections, maintenance and other work required to deliver water required for the project.

- a. As soon as construction operations at each floor level require water, extend service, the full height of the building to form a temporary water and fire water standpipe. Provide distribution piping for temporary water to each location of use. As a minimum, provide one 3/4-inch outlet for each floor level of construction spaced so that water can be reached with a 100 foot length of hose. Provide one 3/4-inch flexible rubber hose 100 feet long with an adjustable nozzle, at each outlet where work requiring water is in progress.
 - b. Install devices necessary to prevent backflow and cross-connections that could contaminate potable water systems, in accordance with the regulations and guidelines of the District of Columbia Water and Sewer Authority (DC WASA).
- 6. **Temporary Sanitary Facilities:** Sanitary facilities include temporary toilets, wash facilities and drinking water fixtures. Use of the designated existing Government toilet facilities, will be permitted, provided these facilities are properly cleaned and maintained in a condition acceptable to the Government. Immediately prior to Final Acceptance, restore these facilities to the condition prevalent at the time of initial use. Do not clean tools or equipment in building toilet rooms.
 - a. **Supply and maintain** toilet tissue, paper towels, paper cups and similar disposable materials as appropriate for each facility. Provide appropriate covered waste containers for used material.
- 7. **Temporary Fire Protection:** Until fire protection needs may be fulfilled by permanent facilities, install and maintain temporary fire protection facilities of the types needed to adequately protect against reasonably predictable and controllable fire losses. Comply with applicable recommendations of NFPA Standard 10 "Standard for Portable Fire Extinguishers". Locate fire extinguishers where they are most convenient and effective for their intended purpose, but provide not less than one extinguisher on each floor at or near each usable stairwell. Store combustible materials in clearly-labeled containers in recognized fire-safe locations.
 - a. **Develop and supervise** an overall fire prevention and first aid fire protection program for personnel at the project site.
 - b. **Provide type "A" fire extinguishers** for temporary offices and similar spaces where there is minimal danger of electrical or grease-oil-flammable liquid fires.
 - c. **Maintain an adequate safeguard** on the site for a period of thirty (30) minutes following the cessation of welding or burning operations, including but not limited to after completion of work at end of shift, lunch breaks and temporary work.
 - d. **Where temporary water outlets** are available, provide hoses of sufficient length to reach construction areas. Hang hoses with a warning sign, to the effect that hoses are for fire protection purposes and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.
 - e. **At the earliest feasible date** in each area of the project, complete installation of the permanent fire protection facility, including connected

services, and place into operation and use. Instruct key personnel at the site on how to use facilities which may not be self-explanatory.

E. **Temporary Construction and Support Facilities:**

1. **Field Offices and Sheds:** Provide a reasonably neat and uniform appearance in temporary construction and support facilities acceptable to the Government. For temporary offices, fabrication shops, storage sheds and similar construction, provide either standard prefabricated or mobile units or the equivalent job-built construction. Provide support facilities that can be maintained properly throughout their use at the project site.
 - a. **Provide fire-resistant construction** for offices, shops, and sheds located within the construction work area, or within 50 feet of building lines.
 - b. **Locate field offices,** storage and fabrication sheds and other support facilities for easy access to the Work within the allocated staging area so that facilities will not block required exits or firefighters' access to the building.
 - c. **Except as otherwise indicated,** make the changeover from use of temporary services and facilities to use of permanent services and facilities at the earliest feasible date at each portion of the building, to minimize hazards and interferences with performance of the Work.
 - d. **Maintain field offices,** storage and fabrication sheds, temporary sanitary facilities, waste collection and disposal systems, and project identification and temporary signs until near final acceptance. Immediately prior to final acceptance, with the Government's approval, remove these facilities.
2. **Field Offices:** Provide temporary field offices of sufficient size to accommodate required office personnel and project meetings at the project site.
3. **Storage and Fabrication Sheds:** Install storage and fabrication sheds or trailers, properly sized, furnished and equipped, as required to accommodate the Work. Comply with applicable provisions specified elsewhere for distribution and use of temporary utilities.
4. **Temporary Enclosures:** At the earliest practical time provide temporary enclosure of materials, equipment, work in progress and completed portions of the Work to provide protection to the Work and employees from effects of exposure, foul weather, other construction operations, and similar activities on the site.
 - a. Provide temporary enclosures where temporary heat is needed and the permanent building enclosure is not yet completed, and there is no other adequate provision for containment of temporary heat. Coordinate enclosures with ventilation and material drying or curing requirements to avoid dangerous conditions and effects.
5. **Temporary Partitions:** Erect and maintain dustproof partitions and temporary enclosures to limit dust and dirt migration and to separate areas from fumes and noise.

- a. Construct dustproof partitions of not less than nominal 4-inch (100-mm) studs, 5/8-inch (16-mm) Type X gypsum wallboard with joints taped on occupied side, and ½-inch (13-mm) fire-retardant plywood on construction side.
 - b. Construct dustproof, floor-to-ceiling partitions of not less than nominal 4-inch (100-mm) studs, 2 layers of 6-mil (0.14-mm) polyethylene sheets, inside and outside temporary enclosure. Cover floor with 2 layers of 6-mil (0.14-mm) polyethylene sheets, extending sheets 18 inches (460 mm) up the side walls. Overlap and tape full length of joints. Cover floor with 3/4-inch (19-mm) fire-retardant plywood.
 - 1) Construct a vestibule and airlock at each entrance to temporary enclosure with not less than 48 inches (1219 mm) between doors. Maintain water-dampened foot mats in vestibule.
 - c. Insulate partitions to provide noise protection to occupied areas.
 - d. Seal joints and perimeter. Equip partitions with dustproof doors and security locks.
 - e. Protect air-handling equipment.
 - f. Weatherstrip openings.
6. **Construction Aids:** Design, construct, and maintain construction aids and miscellaneous general services and facilities as needed to accommodate performance of the work. Construction aids and miscellaneous general services and facilities include, but are not limited to the following:
- a. **Provide temporary stairs** where ladders are not adequate for performance of work, and until permanent stairs are available. Cover finished permanent stairs which will be exposed to occupants' use, with a durable protective covering of plywood or similar material so that finishes will be undamaged at the time of acceptance.
 - b. **Provide scaffolds** as required for proper execution of the Work. Remove or relocate scaffolds promptly to avoid interference with other trades. Provide stairs for vertical circulation.
 - c. **Provide adequate guardrails and barriers** at perimeters of each level of construction as work progresses in accordance with District of Columbia requirements and in conformance with requirements of the Special Conditions.
 - d. **Provide adequate facilities** for hoisting materials and employees. Do not permit employees to ride hoists which comply only with requirements for hoisting materials. The Contractor is responsible for selection of type, size and number of facilities. Truck cranes and similar devices used for hoisting are considered as being "tools and equipment" and not temporary facilities.
 - e. **Chutes:** Do not permit free dropping of materials, rubbish or debris, but remove by use of material hoist and/or rubbish chute. Locations of all hoists and chutes are subject to approval by the Government.

1. Protect building from use of hoists and chutes to prevent damage, marring or staining of permanent work. Brace and guy securely and provide safety devices as required by code.
 7. **Project Signage:** No signs, other than safety signs, may be erected on the site unless specifically indicated otherwise.
 8. **Access Roads:** To the fullest extent possible, locate temporary roads and paving for storage areas and temporary parking, in the same locations as permanent facilities for similar uses. To incorporate temporary paving provisions, review significant modifications of permanent paving requirements with the Government for acceptance of the proposed improvements.
 - a. **Provide temporary traffic control** facilities at the juncture of temporary roads with public roads, including warning signs for public traffic and "STOP" signs for the access road entrance onto public roads. Comply with requirements and recommendations of local traffic authorities.
- F. **Security and Protection Facilities:** Provide and maintain all necessary barricades, lights, and other safeguards for the protection of Members of Congress, Government employees, Contractor's employees and the general public from injury. Protect materials and work on the site, whether incorporated in the work or not, against damage or loss from any cause.
1. **Protect all** electric, telephone, water, gas, sewer, steam, and other underground utility lines in sidewalks, streets or other areas, in, under or around the site, to the satisfaction of the Government, the District of Columbia, and other authorities having jurisdiction. Prior to commencing work which may affect or disturb underground utilities, consult with the Government.
 2. **Provide a reasonably neat** and uniform appearance in security and protection facilities acceptable to the Government.
 3. **Except for utilization** of permanent fire protection facilities, as soon as available in each area, do not change over from use of temporary security and protection facilities to use of permanent facilities until near final acceptance, or for longer periods of time as requested by the Government.
 4. **Barricades and Fences:** Comply with recognized standards and code requirements for the erection of substantial, structurally adequate barricades where needed to prevent accidents and losses. Paint with appropriate colors, graphics and warning signs to inform personnel at the site and the public, of the hazard being protected against. Provide lighting where appropriate and needed, including flashing red lights where appropriate.
 - a. **When excavation** or other substantial elements of the Work begin, install a general enclosure fence with suitable lockable entrance gates. Locate where indicated, or if not indicated, enclose substantially the entire site or portion thereof determined to be sufficient to accommodate the entire construction operation. Install in a manner that will prevent persons, dogs and similar animals from easily entering the site, except by way of the entrance gates when open.

5. **Sidewalk Bridge and Walkway:** Erect a substantial, structurally adequate protective bridge for the passage of persons along the walkway wherever the possibility exists that materials might be hoisted from the roadway, across walkway and onto site. Coordinate with project entrance gates and other facilities and obstructions. Comply with governing regulations and requests of governing authorities.
 - a. **Construct the sidewalk bridge** using heavy scaffold or shoring type framing, waterproofed heavy wood plan-K overhead decking, protective plywood enclosure walls, handrails, barricades, warning signs, lights, safe and well-drained walkways and similar provisions for protection and safe passage. Paint and maintain the facility in a manner acceptable to the Government.
 - b. **Construct the back wall** to serve as the project enclosure fence. Extend the framed plywood backwall beyond the bridge structure, as needed, to complete the enclosure fence.
6. **Security Enclosure and Lockup:** Install substantial and durable general temporary enclosure of partially completed areas of construction. Provide locking entrances adequate to prevent unauthorized entrance, vandalism, theft and similar deleterious effects and violations of project security. Provide copies of access keys to the United States Capitol Police.

G. **Temporary Controls:**

1. **Traffic Control:** Plan vehicular access methods, locations and timing of deliveries in a manner to minimize interference with street and pedestrian traffic and to conform to District of Columbia regulations. Do not block or obstruct public streets, driveways and walkways adjacent to the site at any time during performance of the work without proper authorization. Do not permit trucks of any kind to use existing sidewalks without prior authorization of the Government.
2. **Collection and Disposal of Wastes:** Establish a system for daily collection and disposal of waste materials from construction areas and elsewhere on the site. Enforce requirements strictly. Do not hold collected materials at the site longer than 7 days during normal weather or 3 days when the daily temperature is expected to rise above 80 deg. F (27 deg. C). Handle waste materials that are hazardous, dangerous, or unsanitary separately from other inert waste by containerizing appropriately.
 - a. Recycle or dispose of waste in accordance with applicable federal, state, and local regulations, and cooperate with the AoC Environmental Branch to manage waste generated by the work of the project.
 - b. Burying or burning of waste materials on the site will not be permitted.
 - c. Washing solid waste materials down sewers or into waterways will not be permitted.
 - d. Provide rodent proof containers located on each floor level of construction work, to encourage depositing of garbage and similar wastes by construction personnel.

3. **Janitorial Services:** Provide daily janitorial services for temporary offices, first aid stations, toilets, wash facilities, lunchrooms and similar areas. Require users of other temporary facilities to help maintain a clean and orderly premises.
4. **Dust Control:** During periods of construction activity creating dust conditions sprinkle periodically the site areas disturbed by Contractor's operation or treat with dust suppressors to control dust. Dry power brooming will not be permitted. Use vacuuming, wet mopping, wet sweeping or wet power brooming. Air blowing will be permitted only for cleaning non-particulate debris. Use only wet cutting procedures for unit masonry and concrete.
 - a. Provide barriers constructed as required in "Temporary Partitions," above.
 - b. Seal registers, grilles, and other openings to prevent dust from entering other areas.
5. **Noise Control:** Avoid the use of tools and equipment that produce harmful noise. Restrict the use of noise making tools and equipment to hours of use that will minimize noise complaints from persons or firms near the project site.
 - a. Provide partitions insulated to provide noise protection as required in "Temporary Partitions," above.
 - b. Conduct operations in accordance with District of Columbia noise regulations in Title 20, Chapters 27 through 29.
 - c. No noise is permitted during times when building is occupied by Congress. Suspend work if necessary.
6. **Rodent and Pest Control:** Early in the construction process before deep foundation work has been completed, retain a recognized local exterminator or insect-and-pest control company to recommend practices that will minimize attraction and harboring of rodents, roaches and other pests. Employ this service to perform extermination and control procedures at regular intervals so that the project will be relatively free of pests and their residues at substantial completion. Perform control operations in a lawful manner using environmentally safe materials.
7. **Environmental Protection:** Provide general protection facilities, operate temporary facilities, conduct construction activities, and enforce strict discipline for personnel on the site in ways and methods that comply with environmental regulations, and that minimize the possibility that air, waterways and subsoil might be contaminated or polluted, or that other undesirable effects might result from the performance of work at the site.
8. **Sewers and Drainage:**
 - a. If existing sewers are available for temporary drainage near the site before completion of permanent sewers, provide temporary connections to remove effluent that can be discharged into the sewers in accordance with federal, state, and local regulations.
 - b. If existing sewers are not available, or cannot be used in accordance with federal, state, and local regulations, provide collection methods and containers for effluents and dispose of them off the site in accordance with federal, state, and local regulations.

9. **Dewatering Facilities and Drains:** For temporary drainage and dewatering facilities and operations not directly associated with performance of work included under individual work sections, comply with dewatering requirements of applicable Division-2 sections. Where feasible, utilize the same facilities. Maintain the site, excavations and construction free of water.
 10. **Snow and Ice Control:** Keep access to building and work areas clear of snow adequately to permit access while work is in progress. Do not allow snow and ice to accumulate so as to overload or otherwise endanger any portion of the Work. Do not allow snow and ice to accumulate over surfaces that can be damaged upon thawing.
- H. **Installation, Operation, Termination and Removal:** Use qualified tradesmen for installation of temporary services and facilities. Locate temporary services and facilities where they will serve the entire project adequately and result in minimum interference with the performance of the Work.
1. **Supervision:** Limit availability of temporary services and facilities to essential and intended uses to minimize waste and abuse. Do not permit temporary installations to be abused or endangered. Do not allow hazardous, dangerous or unsanitary conditions to develop or persist on the project site.
 2. **Maintenance:** Operate and maintain temporary services and facilities in good operating condition throughout the time of use and until removal is authorized. Protect from damage by freezing temperatures and similar elements.
 - a. **Prevent water filled piping from freezing** by use of ground covers, insulation, by keeping drained or by temporary heating. Maintain distinct markers for underground lines. Protect from damage during excavation operations. Prevent contamination of water sources.
 3. **Termination and Removal:** Unless the Government requests that it be maintained for a longer period of time, remove each temporary service and facility promptly when the need for it or a substantial portion of it has ended, or when it has been replaced by the authorized use of a permanent facility, or no later than substantial completion. Repair damaged work, clean exposed surfaces and replace work which cannot be satisfactorily repaired. Contract time includes the time required for final cleanup of premises.
 - a. **Remove temporary roads** and paving materials which are not intended for or acceptable for integration into permanent paving. Where the area shown is intended for landscape development, remove soil and aggregate fill that does not comply with requirements for fill or subsoil in the landscape area. Remove materials contaminated with road oil, asphalt and other petro-chemical compounds, and other substances which might impair growth of plant materials or lawns. Repair or replace street paving, curbs and sidewalks at the temporary entrances, as required by the governing authority.

- b. **Immediately prior to final acceptance**, clean and renovate permanent services and facilities that have been used to provide temporary services and facilities during the construction period.
- c. **Restoration of Site and Adjacent Areas** : Restore the site and the adjacent areas used for staging, traffic, protection and storage of materials to their conditions prior to start of work. This includes, but is not limited to all site improvements, signage, lighting, street furniture, paving, sprinkler systems, utilities, plant, trees and turf materials. Procedures which may be required include de-compaction of compacted soils, addition of soil amendments, aeration, re-grading and removal of contaminated materials or other procedures as may be necessary.

1.8 PRODUCTS:

- A. **General:** Refer to clause, "Materials and Workmanship," of the GENERAL CONDITIONS. After execution of the Contract, the Contractor's requests for changes in the products, materials, equipment and methods of construction required by the Contract Documents are considered requests for "contract modifications," and are subject to the requirements specified in Government of the Capitol, "Official Procedure for Making Changes in Contracts." Revisions to the contract documents, where requested by the Government are considered as "changes" not substitutions.
- B. **Quality Assurance:** Compatibility of products is a basic requirement of product selection. When the Contractor is given the option of selecting between two or more products for use on the project, the product selected must be compatible with other products previously selected, even if the products previously selected were also Contractor options. The complete compatibility between various choices available to the Contractor is not assured by the various requirements of the Contract Documents, but must be provided by the Contractor. Provide a single product for each required product selection, regardless of whether that product selection is provided by more than one sub-contractor. Do not alter product brands or series for a given product selection during the life of the contract without written approval of the Government.
 - 1. **Source Limitations:** To the fullest extent possible and subject to the restrictions of the "Buy American Act," provide products of the same generic kind, from a single source, for each unit of work.
- C. **Product Delivery, Storage, and Handling:** Deliver, store, and handle products in accordance with manufacturer's recommendations, using means and methods that will prevent damage, deterioration and loss, including theft. Control delivery schedules to minimize storage at the site and to prevent overcrowding of construction spaces, and to ensure minimum holding or storage times for items known or recognized to be flammable, hazardous, easily damaged, or sensitive to deterioration or loss.
 - 1. **Deliver products** to the site in the manufacturer's sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, ventilating, and installing.

2. **Store products** at the site in a manner that will facilitate inspection and measurement of quantity or counting of units, and in conformance with manufacturer's instructions.
 3. **Store heavy materials** away from the project site. There will be no space allocated for heavy materials storage..
 4. Provide convenient access to Material Safety Data Sheets for each material and product.
- D. **General Product Compliance:** Requirements for individual products are indicated in the Contract Documents; compliance with these requirements is in itself a contract requirement. These requirements may be specified in any one of several different specifying methods, or in any combination of these methods.
1. **Procedures for Selecting Products:** The Contractor's options in selecting products are limited by requirements of the Contract Documents and governing regulations. They are not controlled by industry traditions or procedures experienced by the Contractor on previous construction projects.
 - a. **Performance Specification Requirements:** Where the specifications require compliance with indicated performance requirements, provide products that comply with the specific performance requirements indicated, and that are recommended by the manufacturer for the application indicated. The manufacturer's recommendations may be contained in published product literature, or by the manufacturer's individual certification of performance. General overall performance of a product is implied where the product is specified for specific performances.
 - b. **Compliance with Standards, Codes and Regulations:** Where the specifications require only compliance with an imposed standard, code or regulation, the Contractor has the option of selecting a product that complies with specification requirements, including the standards, codes and regulations.
- E. **General Product Requirements:** Provide products that comply with the requirements of the contract documents and that are undamaged and, unless otherwise indicated, unused at the time of installation. Provide products that are complete with all accessories, trim, finish, safety guards and other devices and details needed for a complete installation and for the intended use and effect.
1. **Provide products** that are essentially the standard catalogued products of manufacturers regularly engaged in production of such products and that are the manufacturer's latest standard design that complies with the specification requirements. Equipment shall essentially duplicate items that have been in satisfactory commercial and industrial use at least two years, or more if otherwise specified, prior to bid opening; or in lieu thereof shall have been used and operated in a test installation which, in the opinion of the Government, duplicate its field performance for the same period of time. The Government reserves the right to require the Contractor to submit evidence to this effect for his approval. When two units of the same class of equipment are required, these units shall be the product

- of a single manufacturer; however, the component parts of the system need not be the products of the same manufacturer.
2. **Provide standard**, domestically produced products for which the manufacturer has published assurances that the products and its parts are likely to be available to the Government at a later date.
 3. **Nameplates**: Except as otherwise indicated for required labels and operating data, do not permanently attach or imprint manufacturer's or producer's nameplates or trademarks on exposed surfaces of products which will be exposed to view either in occupied spaces or on the exterior of the completed project.
- F. **Installation of Products**: Except as otherwise indicated in individual sections of these specifications, comply with the manufacturer's instructions and recommendations for installation of the products in the applications indicated. Anchor each product securely in place, accurately located and aligned with other work. Clean exposed surfaces and protect surfaces as necessary to ensure freedom from damage and deterioration at time of acceptance.
1. Mechanical and electrical installation: In addition to code-required access and clearances, ensure that arrangements and installations accommodate Government's lockout / tagout procedures.

1.9 PROJECT CLOSEOUT:

- A. **Definitions**: "Project Closeout" is the term used to describe certain collective project requirements, indicating completion of the work that are to be fulfilled near the end of the Contract Time in preparation for final acceptance and occupancy of the Work by the Government, as well as final payment to the Contractor and the normal termination of the Contract.
1. **Time of closeout** is directly related to "Final Acceptance." Therefore, the time of closeout may be either a single time period for the entire Work or a series of time periods for individual elements of the Work that have been certified as substantially complete at different dates. This time variation, if any, shall be applicable to the other provisions of this Division.
- B. **Final Cleaning**: Special cleaning requirements for specific units of Work are included in the appropriate sections of Division 2 through 16. General Cleaning during the regular progress of the Work is required by the GENERAL CONDITIONS and is included under Article "Temporary Facilities and Controls".
1. **Cleaning**: Provide final cleaning of the Work at the time indicated. Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit of work to the condition expected from a normal, commercial building cleaning and maintenance program. Comply with the manufacturer's instructions for operations.
 - a. **Complete the following** cleaning operations before requesting the Government's inspection for Final Acceptance.

- b. **Remove labels** which are not required as permanent labels.
 - c. **Clean transparent materials**, including mirrors and glass in doors and windows, to a polished condition. Remove putty and other substances which are noticeable as vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials.
 - d. **Clean exposed** exterior and interior hard-surfaced finishes to a dust-free condition, free of dust, stains, films and similar noticeable distracting substances. Restore reflective surfaces to their original reflective condition. Leave concrete floors broom clean. Vacuum carpeted surfaces.
 - e. **Wipe surfaces** of mechanical and electrical equipment clean. Remove excess lubrication and other substances. Clean plumbing fixtures to a sanitary condition. Clean light fixtures and lamps.
 - f. **Clean the project site**, including landscape development areas, of rubbish, litter and other foreign substances. Sweep paved areas to a broom clean condition; remove stains, spills and other foreign deposits. Rake grounds that are neither paved nor planted, to a smooth even-textured surface.
2. **Compliance:** Comply with safety standards and governing regulations for cleaning operations. Recycle or dispose of waste in accordance with applicable federal, state, and local regulations.
- a. **Where extra materials** of value remaining after completion of associated work have become the Government's property, salvage or dispose of these materials to the Government's best advantage as directed.

C. **Record Documents:** .

- 1. Maintain on site one set of the following record documents; record actual revisions to the work:
 - a. Contract drawings.
 - b. Specifications.
 - c. Amendments.
 - d. Changes to the Contract.
 - e. Reviewed shop drawings, product data, and samples.
 - f. Other record submittals, if any, required in individual specification sections.
- 2. Maintain record documents separate from documents used for construction; protect from deterioration and loss in a secure, fire-resistive location; provide access to record documents for the Architect's reference during normal working hours.
 - a. Drawings: Organize into manageable sets, bind with durable paper cover sheets, and print suitable titles, dates, and other identification on the cover of each set.
- 3. Record information concurrent with construction progress.

4. Mark record documents with red erasable pencil, and where feasible, use other colors to distinguish separate categories of work. Note related numbers of amendments or modifications.
 5. Specifications: Legibly mark and record at each section the description of actual products installed, including:
 - a. Manufacturer's name and product model and number.
 - b. Accepted changes made by amendments and modifications.
 6. Drawings: Contract drawings and shop drawings. Mark to show the actual installation where the installed work varies substantially from the work as originally shown. Mark whichever drawing is most capable of showing the actual "field" or "as-built" condition fully and accurately, but where shop drawing is marked, record a cross-reference at the corresponding location on the contract drawings. Include the following:
 - a. Measured depth of foundations in relation to main floor datum.
 - b. Measured horizontal and vertical locations of underground utilities and structures, relative to permanent surface construction.
 - c. Measured locations of internal utilities and structures concealed in construction, relative to visible and accessible features of the work.
 - d. Field changes of dimension and detail.
 - e. Details not on original contract drawings.
 7. Submit record documents as required in "Closeout Submittals" below.
- D. **Maintenance Manuals:** Organize operating and maintenance data into suitable sets of manageable size. Bind data into individual binders properly identified and indexed. Bind each set of data in a heavy-duty 2-inch, 3-ring vinyl-covered binder, with pocket folders for folded sheet information. Mark the appropriate identification on both front and spine of each binder.
1. Materials and tools: Refer to individual sections of the specifications for required quantities of redundant materials, extra and overrun stock, maintenance tools and devices, keys, and similar items required. Deliver to project site and place in locations directed by the Architect; obtain receipt prior to final payment.
- E. **Warranties and Bonds:** At Final Completion compile two copies of each required warranty and bond properly executed by the Contractor, or by the Contractor, subcontractor, supplier, or manufacturer. Organize the warranty documents into an orderly sequence based on the table of contents of the Project Manual.
1. Bind warranties and bonds in heavy-duty, commercial quality, durable 3-ring vinyl covered loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2" by 11" paper.

- a. Provide heavy paper dividers with celluloid covered tabs for each separate warranty. Mark the tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product, and the name, address and telephone number of the installer.
 - b. Identify each binder on the front and the spine with the typed or printed title "WARRANTIES AND BONDS," the Project title or name, project number, and the name of the Contractor.
 2. When operating and maintenance manuals are required for warranted construction, provide additional copies of each required warranty, as necessary, for inclusion in each required manual.
- F. **General Operating and Maintenance Instructions:** Arrange for each installer of operating equipment and other work that requires regular or continuing maintenance, to meet at the site with the Government's personnel to provide necessary basic instruction in the proper operation and maintenance of the entire Work. Where installers are not experienced in the required procedures, include instruction by the manufacturer's representatives.
1. Instruction shall include demonstration of lockout/tagout procedures and location and operation of devices for lockout/tagout of each item of equipment.
 2. Videotape each instruction session, including instructions required in technical sections for equipment. Include a complete set of videotapes with the Operation and Maintenance Data.
- G. **Closeout Submittals:** Prior to requesting Final Inspection, submit the following:
1. Project Record Documents, properly annotated and in the format required.
 2. Copies of Warranties and Bonds.
 3. Operation and Maintenance data.
 4. All required operating or special tools required in individual sections.
 5. All required keys and keying schedules.
- H. **Prerequisites to Final Acceptance:** Complete the following before requesting the Government's final inspection for certification of final acceptance, and final payment as required by the GENERAL CONDITIONS. List known exceptions, if any, in the request.
1. **Submit the final payment** request with final releases and supporting documentation not previously submitted and accepted. Include certificates of insurance for products and completed operations where required.
 2. **Submit an updated final statement**, accounting for final additional changes to the Contract Sum.
 3. **Submit a certified copy** of the Government's final punch-list of itemized work identified to be completed or corrected, stating that each item has been completed or otherwise resolved for acceptance and has been endorsed and dated by the Government.

4. **Submit final meter readings for utilities**, a measured record of stored fuel, and similar data either as of the date of substantial completion, or else when the Government took possession of and responsibility for corresponding elements of the Work.
 5. **Submit** consent of surety.
- I. **Reinspection Procedures:** The Government will reinspect the Work upon receipt of the Contractor's notice that the work, including punchlist items resulting from earlier inspections, has been completed, except for these items whose completion has been delayed because of circumstances that are acceptable to the Government.
- J. **Removal of Protection:** Except as otherwise indicated or requested by the Government, remove temporary protection devices and facilities which were installed during the course of the work to protect previously completed work during the remainder of the construction period.

END OF SECTION 01000

SECTION 01546 - SAFETY AND HEALTH**PART 1 - GENERAL****1.1 DESCRIPTION OF WORK:**

- A. **General:** This section, general in nature, is applicable to all work performed under this contract and identifies some of the precautions necessary to protect the safety and health of employees, visitors, occupants and contract employees, and to prevent the loss of or damage to property and the environment.
 - 1. Note the Construction Contractor submittal requirements outlined in Part 1 article "Submittals" of this Section.
- B. Related Work: Division 13 Section "Lead Abatement."

1.2 REFERENCES:

- A. **General:** The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only. Exclusion of any specific regulations/standards required by Federal and/or local codes does not relieve the Contractor of their legal and contractual obligations to adhere to such requirements.
- B. **National Standards / Code of Federal Regulations (CFRs):**
 - 1. 29 CFR 1910 - OSHA Occupational Safety and Health Standards.
 - 2. 29 CFR 1926 - OSHA Safety and Health Regulations for Construction.
 - 3. 40 CFR Parts 700-799, Subchapter R - Toxic Substance Control Act (TSCA).
 - 4. 40 CFR Parts 50-99, Air Programs.
 - 5. 40 CFR Parts 260-299, Hazardous Waste Management System (radionuclides).
 - 6. 40 CFR Part 761 - Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions.
 - 7. 40 CFR Parts 104-140 and 401-471, Water Programs.
 - 8. DOT Manual of Uniform Traffic Control Devices.
 - 9. Americans with Disabilities Act (ADA), current with updates.
- C. **Related Building and System Codes:**
 - 1. International Building Code (IBC), 2003.
 - 2. International Existing Building Code (IEBC), 2003.
 - 3. National Fire Code - NFPA 101, 2003.
 - 4. National Electrical Code (NEC), NFPA 70-2005.
 - 5. International Mechanical Code, 2003.
 - 6. International Plumbing Code, 2003.
- D. **Federal Standard 313A - Material Safety Data Sheets, Preparation and Submission.**

- E. **Related** District of Columbia, state, and local regulations shall apply.

1.3 **DEFINITION OF HAZARDOUS MATERIALS:**

- A. **General:** Refer to hazardous and toxic materials/substances, Subparts H and Z of 29 CFR 1910 and related parts of 29 CFR 1926; 40 CFR 261; 40 CFR 761 for PCBs; and to others as defined in Federal Standard 313.
- B. **Those hazardous materials** most commonly encountered can include pesticides, cleaning agents, paints, adhesives, strippers, solvents, asbestos, polychlorinated biphenyls (PCB's), mercury vapor lamps, but may include others. Any unlabeled substance should be handled as hazardous material until properly identified.
- C. **All suspect asbestos containing materials** (e.g., boiler insulation, duct insulation, pipe insulation), surfacing materials (i.e., plaster and sprayed-on fireproofing) and miscellaneous materials (i.e., asphalt flooring, ceiling tiles, adhesives and mastics, drywall, roofing, gaskets and cement board), must be considered asbestos containing unless proven otherwise in accordance with 29 CFR 1926.1101.
- D. **Pre-1978 Surfaces:** All finished/painted surfaces of buildings constructed prior to 1978 shall be considered finished with lead based paint unless proven otherwise.
- E. **Products likely to contain PCB's** include electrical transformers, capacitors, voltage regulators, oil switches, and some fluorescent light ballasts. Transformer vaults with PCB contaminated floors are identified by signage at the entry door (refer to Part 3 of this Section, article "Cautionary Procedures at Existing Vaults").
- F. **Products likely to include mercury** include fluorescent light tubes, switches, gauges, thermostats, and older thermometers.

1.4 **QUALITY ASSURANCE:**

- A. **Pre-Construction Safety Meeting:** Representatives of the Contractor must meet with the Contracting Officer and his/her representative(s) prior to the start of work under this contract. The purpose of the pre-construction meeting is to review the Contractor's Safety and Health Program and Policies, and to discuss the implementation of all safety and health provisions pertinent to the work to be performed under the contract. The Contractor shall be prepared to discuss, in detail, the measures he/she intends to take in controlling any unsafe or unhealthy conditions associated with the work to be performed under the contract. If directed by the Contracting Officer, this meeting may be held in conjunction with other pre-construction meetings such as the General Pre-Construction meeting. The level of detail of the safety meeting is dependent upon the nature of the work and the potential inherent hazards. The Contractor's principal on-site representative(s), the general superintendent and his/her safety representative(s) shall be in attendance.
- B. **Compliance With Regulations:** All work, including contact with and handling of hazardous or regulated materials, the disturbance or dismantling of structures containing

hazardous or regulated materials, and the transport and disposal of hazardous or regulated materials shall comply with the applicable requirements of 29 CFR 1910/1926, 40 CFR, 49 CFR, and all other applicable federal, state, and local regulations.

- C. **Construction Site Lighting:** Lighting intensity levels for construction areas shall meet the minimum requirements established by 29 CFR 1926.56: Illumination, including *Table D-3 - Minimum Illumination Intensities in Foot-Candles*.
- D. **Compliance/Conflicts:** All work shall comply with applicable Federal, state and local safety and health requirements. Where there is a conflict between applicable regulations, the most stringent shall take precedence.
- E. **Contractor Responsibility:** All Contractors shall assume full responsibility and liability for compliance with applicable regulations pertaining to the health and safety of personnel during the execution of work, and shall hold the Government harmless for any action on his/her part, or that of his/her employees or subcontractors, which results in illness, injury or death. The Contractor shall designate a single point-of-contact who is authorized to act on behalf of the contracting firm, authorized to take immediate corrective actions, and assigned the task of daily inspections and reporting outlined herein. Construction Contractors shall comply with the following additional requirements in accordance with 29 CFR 1926.16 (Prime/Subs):
 - 1. Compliance with the accepted Accident Prevention Plan written by the prime Contractor for the specific work, submitted to the government, and reviewed by the COTR. The Contractor's plan will be job specific and will include work to be performed by the subcontractors, and measures to be taken by the Contractor to control hazards associated with materials, services, or equipment provided by suppliers.
 - 2. Regularly scheduled safety meetings shall be held at least once a week for all supervisors on the project to review past activities, to plan ahead for new or changed operations, and to establish safe working procedures for the anticipated hazards. An outline of each meeting shall be submitted through the COTR to the Contracting Officer.
 - 3. At least one "toolbox" safety meeting shall be conducted weekly, by field supervisors or foreman for all workers. An outline report of the meeting, including date, time, duration, attendance, subjects discussed and the name of the director shall be maintained and copies furnished to the designated authority on request.

1.5 SUBMITTALS:

- A. **Submittal "Punch-List:"** A submittal punch list for projects involving "other" hazardous materials as identified in the Construction Contractor's Safety and Health Program and Policies (paragraph B, below) and/or other recognized flammable, corrosive, or toxic products identified in the referenced codes/standards.
- B. **Contractor's Safety and Health Program and Policies:** Submit a Plan of Action for handling hazardous materials (except for asbestos, lead based paint, PCBs and mercury

lamps as they are covered by specific sections) and/or flammable, corrosive or toxic products. Work shall not commence until the Contractor's safety program has been reviewed by the Architect. The Construction Contractor's Plan of Action shall contain the following:

1. Activity Hazard Analysis and Accident Prevention Plan: Identification of anticipated hazards, problems, and proposed mitigation measures/mechanisms.
2. Description of how applicable safety and health regulations and standards are to be met.
3. Protection of the public or others not related to the operation. Maintain code-compliant means of egress for project duration.
4. Means of protection for adjacent non-construction areas, permanent and temporary access ways, and occupants and for controlling noise/dust/fumes/debris generated by the work.
5. Contractor Safety Officer: Identify a lead Safety Officer and alternates, including 24-hour contact information for each.
6. Specialized training and experience of employees to be used for the work.
7. Type of protective equipment and work procedures to be used.
8. Material Safety Data Sheets (MSDSs) for, and proposed procedures for using, disposing of, or storing toxic/hazardous materials (also see 29 CFR 1910.1200). All management and disposal of wastes shall be in accordance with Federal, states and local regulations.
9. Phasing requirements to minimize impact to non-construction work activities.
10. Emergency procedures for handling accidental spills, releases or potential exposures.
11. Interfacing of trades and control of subcontractors, if applicable.
12. Identification of any required analyses, test demonstrations, and validation requirements.
13. Hazard Communications Plan.
14. Trenching and Shoring Plan.
15. Confined Spaces employee certifications and related work procedures.
16. Multi-Employer Worksite Plan.
17. Demolition plans outlining protective measures and responsibilities required under 29 CFR 1926, Subpart T.

- C. **Accident Reporting:** Serious accidents such as those resulting in: treatment of an injury at a medical facility; response by emergency medical personnel; or damage to property other than that of the Contractor will be reported to the contracting officer's representative by telephone within twenty-four hours of the occurrence. A copy of each accident report, which the Contractor or subcontractors submit to their insurance carriers, shall be forwarded through the Contracting Officer's Technical Representative (COTR) to the Contracting Officer (CO) as soon as possible (in no event later than seven (7) calendar days after the occurrence). All accidents/losses shall be reported using AOC "Incident Investigation Report" (from AOC Safety Policy 9-4, available from the COTR) or other form that meets OSHA Standards, as required. Any incident involving fatality or permanent total disability, or property damage to the Government or other property amounting to \$100,000 or more requires immediate notification of the AOC Safety and Occupational Health Branch

(SOHB).

- D. **MSDSs:** The Contractor shall provide copies of each MSDS, in accordance with 29 CFR 1910.1200 - *App E* and with AOC 52.223-1. One copy shall be provided to the Architect's safety officer, and a second copy shall be kept in an MSDS binder on the job site.
- E. **Waste Disposal:** The Contractor shall dispose of all wastes and provide all paperwork, including but not limited to, manifests and disposal certifications, in accordance with all federal, state, and local regulations.
- F. **Hot Work Permits:** When coordinating with the AOC's jurisdiction Superintendent for hot work, submit AOC designated "Hot Work Permit" (from AOC Safety Policy 10-14, available from the COTR) or other form that meets OSHA Standards, as required.
- G. **Worker Certifications:** The Contractor shall provide copies of all worker certifications for handling Hazardous Materials, Working in Confined Spaces, and other certifications required by OSHA, EPA, and local regulatory agencies (not required by other technical sections in the Project Manual).
- H. **Scaffolding:** All scaffolding that is erected on this job will be erected in accordance with the requirements of 29 CFR 1926, Subpart L -- *Scaffolds*. Per OSHA Standards, a scaffold erection plan will be developed by the Contractor, certified by an engineer (licensed in the District of Columbia, Virginia, or Maryland) and provided to the CO prior to set up. Once in place, the Contractor's assigned safety officer shall inspect and document the conditions of the scaffold and scaffold anchor points prior to use, and once per shift thereafter. Any observed failures in the scaffold shall render it unusable until the condition is rectified and re-inspected. Weekly scaffold inspection reports shall be provided to the designated COTR for inclusion in the contract records.
 - 1. **Other Means of Access:** Should the Contractor employ other means of access to the work area, they shall be utilized in accordance with the requirements of 29 CFR 1926, Subpart N -- *Cranes, Derricks, Hoists, Elevators, and Conveyors*. The Contractor shall submit a plan for use of such equipment, fully coordinated with any other plans for site facilities (i.e., scaffolding, staging, etc.).
 - 2. **Scaffolding constructed** by the Contractor for use by AOC employees shall also comply with 29 CFR 1910.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT:

- A. **Special facilities,** devices, equipment, clothing, and similar items used by the Contractor in the execution of work shall comply with all applicable regulations. Such materials and equipment shall be identified in the Plan of Action called for herein.

2.2 MATERIAL SAFETY DATA SHEETS (MSDSs):

- A. **MSDSs** shall be available on-site for all products used under this contract. The prime contractor is responsible for meeting the hazard communication requirements, in accordance with 29 CFR 1910.1200. To the extent feasible, non-flammable, non-corrosive, and non-toxic products shall be used.

PART 3 - EXECUTION

3.1 CAUTIONARY PROCEDURES AT EXISTING VAULTS:

- A. **General:** Transformer vaults may have floors which are PCB contaminated. These vaults are generally marked by blue signs, which identify the vault as PCB-contaminated; assure all vaults are marked with blue signs prior to proceeding with Work. On rare occasions, vault doors in existing buildings may be equipped with protective alarms and devices. Consult the AOC COTR to ascertain whether vault doors in areas under this contract are so equipped and have proper approved signage systems.

3.2 HAZARDOUS MATERIALS:

- A. **General:** The Contractor shall bring to the COTR's attention, any material suspected of being hazardous which he/she encounters during execution of the work. The COTR shall then determine whether the Contractor shall perform tests to determine the nature or toxicity of the material. If the COTR directs the Contractor to perform tests, and/or if the material is found to be hazardous and additional protective measures are needed, a change to the contract may be required (subject to the "AOC Official Procedure for Making Changes to Contracts"). Persons conducting sampling testing and laboratories processing samples shall be certified.

3.3 CONFINED SPACES:

- A. **Confined Spaces:** It is the responsibility of the AOC to identify and demarcate all known confined spaces within our facilities. It is the Contractor's responsibility to notify and coordinate with the Superintendent's Office when confined space work is to be done, obtain permission from this office to enter the space, conduct all required testing of space prior to entry, and complete an entry permit as required by OSHA regulations and the Confined Space Program previously submitted to the AOC COTR for the project.

3.4 PROTECTION:

- A. **Contractor Responsibility:** The Contractor shall take all necessary precautions to prevent injury to the public, building occupants and visitors, and damage to or contamination of property or the environment. For the purposes of this contract, the public or building occupants shall include all persons not employed by the Contractor or subcontractor thereof.
- B. **Welding, Cutting, and Brazing:** The AOC specifically requires a permit for welding, cutting, and brazing. This AOC "Hot Work Permit" shall be approved each day by the AOC Superintendent's Safety Specialist, or his/her designee, and coordinated through the Superintendent's Office whenever welding, cutting or any open flame work is performed.

Work areas shall be kept clear of combustibles within a 35-foot radius of any hot work. Combustibles which cannot be removed shall be covered with flame-resistant blankets. Compressed gas cylinders shall be secured in a vertical position and stored in accordance with Compressed Gas Association (GSA) Guidelines at all times. Valve protection caps shall be in place whenever cylinders are not in use, moved or stored. Appropriate fire extinguishers shall be maintained at welding and cutting operations. A designated fire watch shall sign and return the permit. The fire watch shall be on duty during operations and for a minimum of 30 minutes after completion of welding or cutting operations to ensure no possibility of fire exists.

1. Provide adequate ventilation to protect employees from fume or gas exposure.
 2. During arc welding activities erect screens to shield activities.
- C. **Storage:** It is prohibited to store, position, or use equipment, tools, materials, scraps, and trash in a manner likely to present a hazard to the public or building occupants by its accidental shifting, ignition, or other hazardous qualities. Storing of combustible or flammable liquids shall be in accordance with the current edition of the National Fire Code for Flammable and Combustible Materials (NFPA 30). Compressed gases shall be stored in accordance with Compressed Gas Association (CGA) guidelines.
- D. **Obstructions:** No corridor, aisle, stairway, door, or exit shall be obstructed or used in such a manner as to encroach upon routes of ingress or egress utilized by the public or building occupants, or to present an unsafe or unhealthy condition to the public or building occupants.
- E. **Housekeeping:** Housekeeping practices shall be in conformance with OSHA 29 CFR 1910.22, 29 CFR 1910.141, 29 CFR 1910.1001, 29 CFR 1910.1025, 29 CFR 1926.25, 29 CFR 1926.62, and 29 CFR 1926.1101, for non-construction and construction contracts respectively.
- F. **Protection of the Public and Federal Employees:** Work shall not be performed in any area occupied by the public or Federal employees unless the Contractor takes adequate steps for the protection of the public and Federal employees, and work is specifically permitted by the contract/COTR/jurisdiction Superintendent. Comply with requirements of ANSI A10.34.2001.
- G. **Electrical Systems:** In addition to complying with the referenced standards in this Section, refer to Division 1 requirements for "Temporary Facilities and Controls." Provide compliant electrical supply, overload/ground fault protection, lighting, and signage/notification systems. Ensure that arrangements and installations accommodate the Architect's lockout/tagout procedures.
- H. **Mechanical Systems:** Mechanical systems and equipment, and the components thereof, will be arranged and installed to provide ready accessibility and ease of lock/tag application during lockout/tagout procedures for AOC employees, post construction.
- I. **Fences & Barricades:** The work area shall be fenced, barricaded, or otherwise segregated

from the public or building occupants to prevent unauthorized entry into the work area. Fence elements shall be installed in such a manner as to overcome the negative or hazardous effects of wind and weather typical to the region. The use of barbed wire is prohibited unless requested in writing by the Architect.

- J. **Pedestrian Access Ways:** All interior and exterior paths of travel established for pedestrian circulation within and around a construction site shall meet the requirements of 28 CFR Part 36 (*ADAAG*), Appendix A (Standards for Accessible Design), Articles 4.3 through 4.5; when a path is changed to accommodate work, the Contractor shall also provide directional signage in accordance with the Manual on Uniform Traffic Control Devices (MUTCD), 2003. All paths shall be maintained clear and level, without obstruction. Any proposed exceptions to these requirement must be approved in writing by the Architect prior to construction.
1. **Lighting:** All interior/exterior access ways, both permanent and temporary, shall be provided with a uniform minimum lighting level of 3 footcandles (fc) at the walking surface, in accordance with 29 CFR 1926.56(a), Table D-3 - *Minimum Illumination Intensities in Foot-Candles*.
- K. **Alternate Precautions:** When the nature of the work prevents isolation of the work area and the public or building occupants may be in or pass through, under or over the work area, alternate precautions such as the posting of signs, warning lights, the use of signal persons, the erection of barricades or similar controls around particularly hazardous operations shall be approved and used.
- L. **Work Over Thoroughfares:** When work is to be performed over a public thoroughfare such as a sidewalk, lobby, or corridor, the thoroughfare shall be closed, if possible, or other precautions taken such as the installation of screens or barricades. When exposure to falling objects exists, as during the erection of building walls or during demolition, special protection of the type detailed in 29 CFR 1910/1926 shall be provided.
- M. **Temporary Construction Barriers:** Temporary construction barriers, partitions which cover a hole in a rated fire wall, protect occupants from noise or vibration, or separate the construction from public access and exit corridors shall be erected floor-to-ceiling, wall-to-wall, and shall remain in place for the duration of the contract. The minimum construction standards for these temporary barriers are specified in "Temporary Partitions" in Division 01 Section "General Requirements".
- N. **Dust and Fume Control Measures:** Work performed adjacent to occupied areas shall be done within dust control barriers (generally constructed of polyethylene sheeting or other barriers as approved by the Architect). To the extent feasible, maintain the work environment at a negative pressure differential with the adjoining occupied areas. The use of fume and odor producing products and materials shall be done in such a manner, or at such a time as to minimize impact on building occupants. Provide measures to minimize migration of dust, fumes, gases, and similar affects into the adjacent areas. Ensure that adequate ventilation is provided to work areas in conformance with OSHA regulations.

- O. **Roof Work:** During the performance of roofing work, employees will be protected as required by the OSHA standards contained in 29 CFR 1926 - subpart M "Fall Protection."
- P. **Removal of Fences and Barricades:** Fences and barricades shall be removed upon completion of the project, in accordance with local ordinance and to the satisfaction of the Contracting Officer or his/her representative(s).
- Q. **Completion of Work:** Do not create or leave hazards unabated (e.g., open or absent electrical panels, unmarked circuit breakers/fuses, faceplates missing from receptacles, open maholes, un-barricaded trenches/excavations, etc.).

END OF SECTION 01546

SECTION 01732 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Demolition and removal of selected portions of building or structure.
 - 2. Salvage of existing items to be reused or recycled.
- B. Related Sections include the following:
 - 1. Division 1 Section "General Requirements" for use of premises, and phasing, and occupancy requirements.
 - 2. Division 1 Section "General Requirements" for temporary construction and environmental-protection measures for selective demolition operations.

1.3 DEFINITIONS

- A. Remove: Detach items from existing construction and legally dispose of them off-site, unless indicated to be removed and salvaged or removed and reinstalled.
- B. Remove and Salvage: Detach items from existing construction and deliver them to Government ready for reuse.
- C. Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.
- D. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.4 MATERIALS OWNERSHIP

- A. Historic items, relics, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, antiques, and other items of interest or value to Government that may be encountered during selective demolition remain Government property. Carefully remove and salvage each item or object in a manner to prevent damage and deliver promptly to location designated by Architect.

1.5 SUBMITTALS

- A. Qualification Data: For demolition firm.

- B. Schedule of Selective Demolition Activities: Indicate the following:
1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Government's on-site operations are uninterrupted.
 2. Interruption of utility services. Indicate how long utility services will be interrupted.
 3. Coordination for shutoff, capping, and continuation of utility services.
 4. Use of elevator and stairs.
 5. Locations of proposed dust- and noise-control temporary partitions and means of egress, affected by selective demolition operations.
 6. Coordination of Government's continuing occupancy of portions of existing building.
 7. Means of protection for items to remain and items in path of waste removal from building.
- C. Inventory: After selective demolition is complete, submit a list of items that have been removed and salvaged.
- D. Predemolition Photographs: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by selective demolition operations. Submit before work begins.

1.6 QUALITY ASSURANCE

- A. Demolition Firm Qualifications: An experienced firm that has specialized in demolition work similar in material and extent to that indicated for this Project.
- B. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- C. Standards: Comply with ANSI A10.6 and NFPA 241.
- D. Predemolition Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "General Requirements."
1. Inspect and discuss condition of construction to be selectively demolished.
 2. Review structural load limitations of existing structure.
 3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
 4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
 5. Review areas where existing construction is to remain and requires protection.

1.7 PROJECT CONDITIONS

- A. Government will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so operations will not be disrupted.
 - 1. Comply with requirements specified in Division 1 Section "General Requirements."
- B. Conditions existing at time of inspection for bidding purpose will be maintained by Government as far as practical.
- C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- D. Hazardous Materials: Hazardous materials are present in construction to be selectively demolished. A report on the presence of hazardous materials is on file for review and use. Examine report to become aware of locations where hazardous materials are present.
 - 1. Hazardous material remediation is specified elsewhere in the Contract Documents.
 - 2. Do not disturb hazardous materials or items suspected of containing hazardous materials except under procedures specified elsewhere in the Contract Documents.
- E. Storage or sale of removed items or materials on-site is not permitted.
- F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
 - 1. Maintain fire-protection facilities in service during selective demolition operations.

1.8 WARRANTY

- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped.
- B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
- C. Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.
- D. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.

- E. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs.
- F. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Services/Systems: Maintain services/systems indicated to remain and protect them against damage during selective demolition operations.
 - 1. Comply with requirements for existing services/systems interruptions specified in Division 1 Section "General Conditions."
- B. Service/System Requirements: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.
 - 1. Architect will arrange to shut off indicated services/systems when requested by Contractor.
 - 2. Arrange to shut off indicated utilities with utility companies.
 - 3. If services/systems are required to be removed, relocated, or abandoned, before proceeding with selective demolition provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
 - 4. Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing.
 - a. Where entire wall is to be removed, existing services/systems may be removed with removal of the wall.

3.3 PREPARATION

- A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
- B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
 - 1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
 - 2. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
 - 3. Cover and protect furniture, furnishings, and equipment that have not been removed.
 - 4. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Division 1 Section "General Requirements."

- C. Temporary Shoring: Provide and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.
 - 1. Strengthen or add new supports when required during progress of selective demolition.

3.4 SELECTIVE DEMOLITION, GENERAL

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
 - 1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
 - 2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
 - 3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
 - 4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain fire watch and portable fire-suppression devices during flame-cutting operations.
 - 5. Maintain adequate ventilation when using cutting torches.
 - 6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
 - 7. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
 - 8. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
 - 9. Dispose of demolished items and materials promptly. Comply with waste management requirements in Division 1 Section "General Requirements."
- B. Removed and Salvaged Items:
 - 1. Clean salvaged items.
 - 2. Pack or crate items after cleaning. Identify contents of containers.
 - 3. Store items in a secure area until delivery to designated location.
 - 4. Transport items to storage area designated by Architect.
 - 5. Protect items from damage during transport and storage.
- C. Removed and Reinstalled Items:

1. Clean and repair items to functional condition adequate for intended reuse. Paint equipment to match new equipment.
 2. Pack or crate items after cleaning and repairing. Identify contents of containers.
 3. Protect items from damage during transport and storage.
 4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.
- D. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.5 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

- A. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals, using power-driven saw, then remove concrete between saw cuts.
- B. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, then remove masonry between saw cuts.
- C. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, then break up and remove.

3.6 DISPOSAL OF DEMOLISHED MATERIALS

- A. General: Except for items or materials indicated to be recycled, reused, salvaged, reinstalled, or otherwise indicated to remain Government's property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.
1. Do not allow demolished materials to accumulate on-site.
 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
 3. Comply with requirements specified in Division 1 Section "Construction Waste Management."
- B. Burning: Do not burn demolished materials.

3.7 CLEANING

- A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION 01732

SECTION 03301 - CAST-IN-PLACE CONCRETE (LIMITED APPLICATIONS)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section specifies cast-in-place concrete, including reinforcement, concrete materials, mixture design, placement procedures, and finishes, for noncritical applications of concrete and for projects using small quantities of concrete.

1.3 SUBMITTALS

- A. General: In addition to the following, comply with submittal requirements in ACI 301.
- B. Product Data: For each type of product indicated.
- C. Design Mixtures: For each concrete mixture.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
- B. Source Limitations: Obtain each type of cement of the same brand from the same manufacturer's plant, obtain aggregate from one source, and obtain admixtures through one source from a single manufacturer.
- C. Comply with ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

PART 2 - PRODUCTS

2.1 FORMWORK

- A. Furnish formwork and formwork accessories according to ACI 301.

2.2 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.
- B. Plain-Steel Wire: ASTM A 82, as drawn.

2.3 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source throughout Project:
 - 1. Portland Cement: ASTM C 150, Type I.
- B. Normal-Weight Aggregate: ASTM C 33, graded, 1-1/2-inch (38-mm) nominal maximum aggregate size.
- C. Water: ASTM C 94/C 94M; potable.

2.4 RELATED MATERIALS

- A. Vapor Retarder: Multi-ply reinforced polyethylene sheet, ASTM E 1745, Class C, or polyethylene sheet, ASTM D 4397, not less than 10 mils (0.25 mm) thick.
- B. Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber, or ASTM D 1752, cork or self-expanding cork.

2.5 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming; manufactured for application to fresh concrete.
- B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) when dry.
- C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- D. Water: Potable.
- E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.

2.6 CONCRETE MIXTURES

- A. Comply with ACI 301 requirements for concrete mixtures.
- B. Normal-Weight Concrete: Prepare design mixes, proportioned according to ACI 301, as follows:
 - 1. Minimum Compressive Strength: 3000 psi (20.7 MPa) at 28 days.
 - 2. Slump Limit: 4 inches (100 mm), plus or minus 1 inch (25 mm).
 - 3. Air Content: Maintain within range permitted by ACI 301. Do not allow air content of floor slabs to receive troweled finishes to exceed 3 percent.

2.7 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, and furnish batch ticket information.
 - 1. When air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.
- B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Mix concrete materials in appropriate drum-type batch machine mixer.
 - 1. For mixer capacity of 1 cu. yd. (0.76 cu. m) or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
 - 2. For mixer capacity larger than 1 cu. yd. (0.76 cu. m), increase mixing time by 15 seconds for each additional 1 cu. yd. (0.76 cu. m).
 - 3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mix type, mix time, quantity, and amount of water added. Record approximate location of final deposit in structure.

PART 3 - EXECUTION

3.1 FORMWORK

- A. Design, construct, erect, brace, and maintain formwork according to ACI 301.

3.2 VAPOR RETARDERS

- A. Install, protect, and repair vapor retarders according to ASTM E 1643; place sheets in position with longest dimension parallel with direction of pour.
 - 1. Lap joints 6 inches (150 mm) and seal with manufacturer's recommended adhesive or joint tape.

3.3 STEEL REINFORCEMENT

- A. Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
 - 1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

3.4 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Locate and install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.

- C. Isolation Joints: Install joint-filler strips at junctions with slabs-on-grade and vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
 - 1. Extend joint fillers full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.

3.5 CONCRETE PLACEMENT

- A. Comply with ACI 301 for measuring, batching, mixing, transporting, and placing concrete.
- B. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.

3.6 FINISHING FORMED SURFACES

- A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defective areas repaired and patched. Remove fins and other projections exceeding 1/2 inch (13 mm).
 - 1. Apply to concrete surfaces on housekeeping pad

3.7 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and with ACI 301 for hot-weather protection during curing.
- B. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.
- C. Curing Methods: Cure formed and unformed concrete for at least seven days by one or a combination of the following methods:
 - 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
 - a. Water.
 - b. Continuous water-fog spray.
 - c. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch (300-mm) lap over adjacent absorptive covers.
 - 2. Moisture-Retaining-CoverCuring: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.8 REPAIRS

- A. Remove and replace concrete that does not comply with requirements in this Section.

END OF SECTION 03301

SECTION 07841 - THROUGH-PENETRATION FIRESTOP SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes through-penetration firestop systems for penetrations through fire-resistance-rated constructions, for openings containing penetrating items.
- B. Related Sections include the following:
 - 1. Division 16 Sections specifying cable and conduit penetrations.

1.3 PERFORMANCE REQUIREMENTS

- A. General: For penetrations through fire-resistance-rated constructions, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated.
- B. Rated Systems: Provide through-penetration firestop systems with the following ratings determined per ASTM E 814 or UL 1479:
 - 1. F-Rated Systems: Provide through-penetration firestop systems with F-ratings indicated, but not less than that equaling or exceeding fire-resistance rating of constructions penetrated.
- C. For through-penetration firestop systems exposed to traffic, moisture, and physical damage, provide products that, after curing, do not deteriorate when exposed to these conditions both during and after construction.
 - 1. For conduit penetrations in air plenums, provide moisture-resistant through-penetration firestop systems.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For each through-penetration firestop system, show each type of construction condition penetrated, relationships to adjoining construction, and type of penetrating item. Include firestop design designation of qualified testing and inspecting agency that evidences compliance with requirements for each condition indicated.

1. Submit documentation, including illustrations, from a qualified testing and inspecting agency that is applicable to each through-penetration firestop system configuration for construction and penetrating items.
- C. Through-Penetration Firestop System Schedule: Indicate locations of each through-penetration firestop system, along with the following information:
 1. Types of penetrating items.
 2. Types of constructions penetrated, including fire-resistance ratings and, where applicable, thicknesses of construction penetrated.
 3. Through-penetration firestop systems for each location identified by firestop design designation of qualified testing and inspecting agency.
- D. Qualification Data: For Installer.
- E. Product Certificates: For through-penetration firestop system products, signed by product manufacturer.
- F. Product Test Reports: From a qualified testing agency indicating through-penetration firestop system complies with requirements, based on comprehensive testing of current products.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A firm experienced in installing through-penetration firestop systems similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements. Manufacturer's willingness to sell its through-penetration firestop system products to Contractor or to Installer engaged by Contractor does not in itself confer qualification on buyer.
- B. Installation Responsibility: Assign installation of through-penetration firestop systems in Project to a single qualified installer.
- C. Source Limitations: Obtain through-penetration firestop systems, for each kind of penetration and construction condition indicated, through one source from a single manufacturer.
- D. Fire-Test-Response Characteristics: Provide through-penetration firestop systems that comply with the following requirements and those specified in Part 1 "Performance Requirements" Article:
 1. Firestopping tests are performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency is UL, or another agency performing testing and follow-up inspection services for firestop systems acceptable to authorities having jurisdiction.

2. Through-penetration firestop systems are identical to those tested per testing standard referenced in "Part 1 Performance Requirements" Article. Provide rated systems complying with the following requirements:
 - a. Through-penetration firestop system products bear classification marking of qualified testing and inspecting agency.
 - b. Through-penetration firestop systems correspond to those indicated by reference to through-penetration firestop system designations listed by the following:
 - 1) UL in its "Fire Resistance Directory."

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver through-penetration firestop system products to Project site in original, unopened containers or packages with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, lot number, shelf life if applicable, qualified testing and inspecting agency's classification marking applicable to Project, curing time, and mixing instructions for multicomponent materials.
- B. Store and handle materials for through-penetration firestop systems to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install through-penetration firestop systems when ambient or substrate temperatures are outside limits permitted by through-penetration firestop system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.
- B. Ventilate through-penetration firestop systems per manufacturer's written instructions by natural means or, where this is inadequate, forced-air circulation.

1.8 COORDINATION

- A. Coordinate construction of openings and penetrating items to ensure that through-penetration firestop systems are installed according to specified requirements.
- B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration firestop systems.
- C. Notify the Government at least seven days in advance of through-penetration firestop system installations; confirm dates and times on days preceding each series of installations.
- D. Do not cover up through-penetration firestop system installations that will become concealed behind other construction until each installation has been examined by the Government, if required by authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, through-penetration firestop systems that may be incorporated into the Work include, but are not limited to, those systems indicated in the Through-Penetration Firestop System Schedule at the end of Part 3.

2.2 FIRESTOPPING, GENERAL

- A. Compatibility: Provide through-penetration firestop systems that are compatible with one another; with the substrates forming openings; and with the items, if any, penetrating through-penetration firestop systems, under conditions of service and application, as demonstrated by through-penetration firestop system manufacturer based on testing and field experience.
- B. Accessories: Provide components for each through-penetration firestop system that are needed to install fill materials and to comply with Part 1 "Performance Requirements" Article. Use only components specified by through-penetration firestop system manufacturer and approved by qualified testing and inspecting agency for firestop systems indicated.

2.3 MIXING

- A. For those products requiring mixing before application, comply with through-penetration firestop system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of work.

- 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning: Clean out openings immediately before installing through-penetration firestop systems to comply with firestop system manufacturer's written instructions and with the following requirements:
 - 1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of through-penetration firestop systems.

2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with through-penetration firestop systems. Remove loose particles remaining from cleaning operation.
 3. Remove laitance and form-release agents from concrete.
- B. Priming: Prime substrates where recommended in writing by through-penetration firestop system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

3.3 THROUGH-PENETRATION FIRESTOP SYSTEM INSTALLATION

- A. General: Install through-penetration firestop systems to comply with Part 1 "Performance Requirements" Article and with firestop system manufacturer's written installation instructions and published drawings for products and applications indicated.
- B. Install forming/damming/backing materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of firestop systems.
- C. Install fill materials for firestop systems by proven techniques to produce the following results:
1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
 2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
 3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 CLEANING AND PROTECTING

- A. Clean off excess fill materials adjacent to openings as Work progresses by methods and with cleaning materials that are approved in writing by through-penetration firestop system manufacturers and that do not damage materials in which openings occur.
- B. Provide final protection and maintain conditions during and after installation that ensure that through-penetration firestop systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated through-penetration firestop systems immediately and install new materials to produce systems complying with specified requirements.

3.5 THROUGH-PENETRATION FIRESTOP SYSTEM SCHEDULE

- A. Where UL-classified systems are indicated, they refer to alpha-alpha-numeric designations listed in UL's "Fire Resistance Directory" under product Category XHEZ.
- B. Firestop Systems for Metallic Pipes, Conduit, or Tubing:
 - 1. UL-Classified Systems: C-BK-1001-1999.
- C. Firestop Systems for Electrical Cables:
 - 1. UL-Classified Systems: C-BK-3001-3999.

END OF SECTION 07841

SECTION 09912 - INTERIOR PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes surface preparation and the application of paint systems on the following interior substrates:
 - 1. Steel.
 - 2. Gypsum board and plaster.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples for Initial Selection: For each type of topcoat product indicated.
- C. Samples for Verification: For each type of paint system and in each color and gloss of topcoat indicated.
 - 1. Submit Samples on rigid backing, 8 inches square.
 - 2. Step coats on Samples to show each coat required for system.
 - 3. Label each coat of each Sample.
 - 4. Label each Sample for location and application area.
- D. Product List: For each product indicated, include the following:
 - 1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
 - 2. Printout of current "MPI Approved Products List" for each product category specified in Part 2, with the proposed product highlighted.

1.4 QUALITY ASSURANCE

- A. MPI Standards:
 - 1. Products: Complying with MPI standards indicated and listed in "MPI Approved Products List."
 - 2. Preparation and Workmanship: Comply with requirements in "MPI Architectural Painting Specification Manual" for products and paint systems indicated.

- B. Mockups: Apply benchmark samples of each paint system indicated and each color and finish selected to verify preliminary selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. The Architect will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.
 - a. Wall and metal frame surfaces: Provide samples of at least 100 sq. ft..
 - 2. Apply benchmark samples after permanent lighting and other environmental services have been activated.
 - 3. Final approval of color selections will be based on benchmark samples.
 - a. If preliminary color selections are not approved, apply additional benchmark samples of additional colors selected by the Architect at no added cost.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
 - 1. Maintain containers in clean condition, free of foreign materials and residue.
 - 2. Remove rags and waste from storage areas daily.

1.6 PROJECT CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.
- B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufactured products are subject to compliance with requirements.

2.2 PAINT, GENERAL

- A. Material Compatibility:
 - 1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 - 2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

- B. Chemical Components of Field-Applied Interior Paints and Coatings: Provide products that comply with the following limits for VOC content, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24) and the following chemical restrictions; these requirements do not apply to primers or finishes that are applied in a fabrication or finishing shop:
1. Flat Paints and Coatings: VOC content of not more than 50 g/L.
 2. Nonflat Paints and Coatings: VOC content of not more than 150 g/L.
 3. Aromatic Compounds: Paints and coatings shall not contain more than 1.0 percent by weight of total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).
 4. Restricted Components: Paints and coatings shall not contain any of the following:
 - a. Acrolein.
 - b. Acrylonitrile.
 - c. Antimony.
 - d. Benzene.
 - e. Butyl benzyl phthalate.
 - f. Cadmium.
 - g. Di (2-ethylhexyl) phthalate.
 - h. Di-n-butyl phthalate.
 - i. Di-n-octyl phthalate.
 - j. 1,2-dichlorobenzene.
 - k. Diethyl phthalate.
 - l. Dimethyl phthalate.
 - m. Ethylbenzene.
 - n. Formaldehyde.
 - o. Hexavalent chromium.
 - p. Isophorone.
 - q. Lead.
 - r. Mercury.
 - s. Methyl ethyl ketone.
 - t. Methyl isobutyl ketone.
 - u. Methylene chloride.
 - v. Naphthalene.
 - w. Toluene (methylbenzene).
 - x. 1,1,1-trichloroethane.
 - y. Vinyl chloride.
- C. Colors: As selected by the Architect from manufacturer's full range.

2.3 PRIMERS/SEALERS

- A. Interior Latex Primer/Sealer: MPI #50.
1. VOC Content: E Range of E2.
 2. Environmental Performance Rating: EPR 3.

B. Interior Alkyd Primer/Sealer: MPI #45.

1. VOC Content: E Range of E2.

2.4 METAL PRIMERS

A. Quick-Drying Alkyd Metal Primer: MPI #76.

1. VOC Content: E Range of E2.

2.5 LATEX PAINTS

A. Institutional Low-Odor/VOC Latex (Flat): MPI #143 (Gloss Level 1).

1. VOC Content: E Range of E3.

2. Environmental Performance Rating: [EPR 4] [EPR 5.5].

B. Institutional Low-Odor/VOC Latex (Eggshell): MPI #145 (Gloss Level 3).

1. VOC Content: E Range of E3.

2. Environmental Performance Rating: EPR 4.5.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Gypsum Board: 12 percent.

C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

D. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.

1. Beginning coating application constitutes Contractor's acceptance of substrates and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated.

- B. Remove plates, machined surfaces, and similar items already in place that are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
 - 2. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
- C. Clean substrates of substances that could impair bond of paints, including dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and reprime substrate with compatible primers as required to produce paint systems indicated.
- D. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
- E. Gypsum Board Substrates: Do not begin paint application until finishing compound is dry and sanded smooth..

3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions.
 - 1. Use applicators and techniques suited for paint and substrate indicated.
 - 2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
 - 3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
- B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

3.4 FIELD QUALITY CONTROL

- A. Testing of Paint Materials: The Architect reserves the right to invoke the following procedure at any time and as often as the Architect deems necessary during the period when paints are being applied:
1. The Architect will engage the services of a qualified testing agency to sample paint materials being used. Samples of material delivered to Project site will be taken, identified, sealed, and certified in presence of Contractor.
 2. Testing agency will perform tests for compliance with product requirements.
 3. The Architect may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying-paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

3.4 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by the Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.5 INTERIOR PAINTING SCHEDULE

- A. Concrete Substrates, Traffic Surfaces:
1. Latex Floor Enamel System: MPI INT 3.2A.
 - a. Prime Coat: Interior/exterior latex floor and porch paint (low gloss).
 - b. Intermediate Coat: Interior/exterior latex floor and porch paint (low gloss).
 - c. Topcoat: Interior/exterior latex floor and porch paint (low gloss).
- B. Steel Substrates:
1. Latex Over Alkyd Primer System: MPI INT 5.1Q.
 - a. Prime Coat: Quick-drying alkyd metal primer.
 - b. Intermediate Coat: Interior latex matching topcoat.
 - c. Topcoat: Interior latex eggshell..

C. Gypsum Board and Plaster Substrates:

1. Institutional Low-Odor/VOC Latex System: MPI INT 9.2M.
 - a. Prime Coat: Interior latex primer/sealer.
 - b. Intermediate Coat: Institutional low-odor/VOC interior latex matching topcoat.
 - c. Topcoat: Institutional low-odor/VOC interior latex flat.

END OF SECTION 09912

SECTION 10200 - LOUVERS AND VENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Fixed, extruded-aluminum louvers.

1.3 DEFINITIONS

- A. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section unless otherwise defined in this Section or in referenced standards.
- B. Horizontal Louver: Louver with horizontal blades; i.e., the axes of the blades are horizontal.
- C. Vertical Louver: Louver with vertical blades; i.e., the axes of the blades are vertical.
- D. Drainable-Blade Louver: Louver with blades having gutters that collect water and drain it to channels in jambs and mullions, which carry it to bottom of unit and away from opening.
- E. Storm-Resistant Louver: Louver that provides specified wind-driven rain performance, as determined by testing according to AMCA 500-L.

1.4 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Louvers shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures shall be considered to act normal to the face of the building.
 - 1. Wind Loads: Determine loads based on a uniform pressure of 30 lbf/sq. ft. (1436 Pa).

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated.
 - 1. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.

- B. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.
 - 1. Show weep paths, gaskets, flashing, sealant, and other means of preventing water intrusion.
 - 2. Show mullion profiles and locations.
- C. Samples for Verification: For each type of metal finish required.

1.6 QUALITY ASSURANCE

- A. Source Limitations: Obtain louvers and vents from single source from a single manufacturer where indicated to be of same type, design, or factory-applied color finish.
- B. Welding: Qualify procedures and personnel according to the following:
 - 1. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
- C. SMACNA Standard: Comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for fabrication, construction details, and installation procedures.

1.7 PROJECT CONDITIONS

- A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), Alloy 6063-T5, T-52, or T6.
- B. Aluminum Sheet: ASTM B 209 (ASTM B 209M), Alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by metal producer for required finish.
- C. Aluminum Castings: ASTM B 26/B 26M, Alloy 319.
- D. Fasteners: Use types and sizes to suit unit installation conditions.
 - 1. Use Phillips flat-head screws for exposed fasteners unless otherwise indicated.
 - 2. For fastening aluminum, use aluminum or 300 series stainless-steel fasteners.
 - 3. For color-finished louvers, use fasteners with heads that match color of louvers.
- E. Postinstalled Fasteners for Concrete and Masonry: Torque-controlled expansion anchors, made from stainless-steel components, with capability to sustain, without failure, a load equal to 4 times the loads imposed, for concrete, or 6 times the load imposed, for masonry, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.

2.2 FABRICATION, GENERAL

- A. Assemble louvers in factory to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
- B. Vertical Assemblies: Where height of louver units exceeds fabrication and handling limitations, fabricate units to permit field-bolted assembly with close-fitting joints in jambs and mullions, reinforced with splice plates.
 - 1. Continuous Vertical Assemblies: Fabricate units without interrupting blade-spacing pattern.
 - 2. Horizontal Mullions: Provide horizontal mullions at joints.
- C. Maintain equal louver blade spacing, including separation between blades and frames at head and sill, to produce uniform appearance.
- D. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.
 - 1. Frame Type: Exterior flange.
- E. Include supports, anchorages, and accessories required for complete assembly.
- F. Provide vertical mullions of type and at spacings indicated, but not more than recommended by manufacturer, or 72 inches (1830 mm) o.c., whichever is less.
 - 1. Fully Recessed Mullions: Where indicated, provide mullions fully recessed behind louver blades. Where length of louver exceeds fabrication and handling limitations, fabricate with close-fitting blade splices designed to permit expansion and contraction.
 - 2. Exterior Corners: Prefabricated corner units with mitered blades with concealed close-fitting splices and with fully recessed mullions at corners.
- G. Join frame members to each other and to fixed louver blades with fillet welds, threaded fasteners, or both, as standard with louver manufacturer unless size of louver assembly makes bolted connections between frame members necessary.

2.3 FIXED, EXTRUDED-ALUMINUM LOUVERS

- A. Horizontal Storm-Resistant Louvers:
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide product that is similar to existing louvers in the Generator Vault.
 - 2. Louver Depth: 5 inches (125 mm) minimum.
 - 3. Frame and Blade Nominal Thickness: Not less than 0.060 inch (1.52 mm) for blades and 0.080 inch (2.03 mm) for frames.

4. Louver Performance Ratings:
 - a. Free Area: Not less than 7.0 sq. ft. (0.65 sq. m) for 48-inch- (1220-mm-) wide by 48-inch- (1220-mm-) high louver.
 - b. Air Performance: Not more than 0.10-inch wg (25-Pa) static pressure drop at or 700-fpm (3.6-m/s) free-area exhaust or intake velocity.
 - c. Wind-Driven Rain Performance: Not less than 95 percent effectiveness when subjected to a rainfall rate of 3 inches (75 mm) per hour and a wind speed of 29 mph (13 m/s) at a core-area intake velocity of 400 fpm (2.0 m/s).
5. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

2.4 LOUVER SCREENS

- A. General: Provide screen at each exterior louver.
 1. Screen Location for Fixed Louvers: Interior face.
 2. Screening Type: Bird screening.
- B. Secure screen frames to louver frames with stainless-steel machine screws, spaced a maximum of 6 inches (150 mm) from each corner and at 12 inches (300 mm) o.c.
- C. Louver Screen Frames: Fabricate with mitered corners to louver sizes indicated.
 1. Metal: Same kind and form of metal as indicated for louver to which screens are attached. Reinforce extruded-aluminum screen frames at corners with clips.
 2. Finish: Same finish as louver frames to which louver screens are attached.
 3. Type: Non-rewirable, U-shaped frames.
- D. Louver Screening for Aluminum Louvers:
 1. Bird Screening: Stainless steel, 1/2-inch- (13-mm-) square mesh, 0.047-inch (1.19-mm) wire.

2.5 BLANK-OFF PANELS

- A. Uninsulated, Blank-Off Panels: Metal sheet attached to back of louver.
 1. Aluminum sheet for aluminum louvers, not less than 0.050-inch (1.27-mm) nominal thickness.
 2. Panel Finish: Same finish applied to louvers.
 3. Attach blank-off panels with sheet metal screws.
- B. Insulated, Blank-Off Panels: Laminated panels consisting of insulating core surfaced on back and front with metal sheets and attached to back of louver.
 1. Thickness: 2 inches (50 mm).

2. Metal Facing Sheets: Aluminum sheet, not less than 0.032-inch (0.81-mm) nominal thickness.
3. Insulating Core: Rigid, glass-fiber-board insulation.
4. Edge Treatment: Trim perimeter edges of blank-off panels with louver manufacturer's standard extruded-aluminum-channel frames, not less than 0.080-inch (2.03-mm) nominal thickness, with corners mitered and with same finish as panels.
5. Seal perimeter joints between panel faces and louver frames with gaskets or sealant.
6. Panel Finish: Same finish applied to louvers.
7. Attach blank-off panels with sheet metal screws.

2.6 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

2.7 ALUMINUM FINISHES

- A. Finish louvers after assembly.
- B. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.
 1. Color: Match existing louvers located in the CVC Generator Vault.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and openings, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

3.3 INSTALLATION

- A. Locate and place louvers and vents level, plumb, and at indicated alignment with adjacent work.
- B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.
- C. Form closely fitted joints with exposed connections accurately located and secured.

- D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.
- E. Repair finishes damaged by cutting, welding, soldering, and grinding. Restore finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alterations, and refinish entire unit or provide new units.
- F. Protect unpainted galvanized and nonferrous-metal surfaces that will be in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.
- G. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Division 7 Section "Joint Sealants" for sealants applied during louver installation.

3.4 ADJUSTING AND CLEANING

- A. Test operation of adjustable louvers and adjust as needed to produce fully functioning units that comply with requirements.
- B. Clean exposed surfaces of louvers and vents that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate during construction period.
- C. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.
- D. Restore louvers and vents damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.
 - 1. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION 10200

SECTION 13282 - LEAD ABATEMENT**PART 1 - GENERAL****1.1 DESCRIPTION**

- A. This section specifies abatement and disposal of lead-containing products, and controls needed to limit occupational and environmental exposure to lead hazards.

1.2 SCOPE OF WORK

- A. Contain and dispose of lead-containing materials during demolition of walls, floors, and door assemblies.
- B. Contain and dispose of lead-containing materials during installation and removal of equipment fastened to existing building surfaces.

1.3 APPLICABLE PUBLICATIONS

- A. **The publications** listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

B. **CODE OF FEDERAL REGULATIONS (CFR):**

29 CFR Part 1910	Occupational Safety and Health Standards
29 CFR Part 1926	Safety and Health Regulations for Construction
40 CFR Part 148	Hazardous Waste Injection Restrictions
40 CFR Part 260	Hazardous Waste Management System: General
40 CFR Part 261	Identification and Listing of Hazardous Waste
40 CFR Part 262	Standards Applicable to Generators of Hazardous Waste
40 CFR Part 263	Standards Applicable to Transporters of Hazardous Waste
40 CFR Part 264	Standards for Owners and Operations of Hazardous Waste Treatment, Storage, and Disposal Facilities
40 CFR Part 265	Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
40 CFR Part 268	Land Disposal Restrictions
40 CFR Part 745	Identification of Dangerous Levels of Lead
49 CFR Part 172	Hazardous Material Table, Special Provisions, Hazardous Material Communications, Emergency Response Information, and Training Requirements
49 CFR Part 178	Specifications for Packaging

C. **National Fire Protection Association (NFPA):**

NFPA 701-1989	Methods of Fire Test for Flame-Resistant Textiles and Films
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D. **National Institute For Occupational Safety And Health (NIOSH)**

- NIOSH OSHA Booklet 3142 Lead in Construction
- E. **Underwriters Laboratories(UL):**

UL 586-1990 High-Efficiency, Particulate, Air Filter Units
 - F. **American National Standards Institute:**

Z9.2-1979(R1991) Fundamentals Governing the Design and Operation of Local Exhaust Systems.
 - G. **HUD's Guidelines For the Evaluation and Control of Lead - Based Paint Hazards in Housing.**
 - H. **District of Columbia Lead-Based Paint Abatement and Control Act of 1996 (DC Law 11-221).**
 - I. **District of Columbia Municipal Regulations (DCMR) 20 DCMR 800.**
 - J. **Code of Maryland Regulations (COMR) Title 26, Subtitle 11, Chapter 21.**
 - K. **Code of Maryland Regulations (COMR) Title 26, Subtitle 11, Chapter 23.**
 - L. **Virginia State Regulations (VSR) 54.1.**

1.4 GENERAL REQUIREMENTS

- A. All painted surfaces are assumed to be coated with one or more layers of lead-containing paint. Treat materials painted with assumed lead-containing paint in a manner to prevent the spread of paint dust and lead debris. Do not begin demolition until authorization is received from the Architect of the Capitol Project Manager and the Architect of the Capitol Safety and Environmental Office Lead Program Manager. Remove rubbish and debris from the work site daily; do not allow accumulations inside or outside of the work area. Store materials that cannot be removed daily in a location specified by the Jurisdiction.

1.5 DEFINITIONS

- A. **Action Level:** Employee exposure, without regard to use of respirations, to an airborne concentration of lead of 30 micrograms per cubic meter of air averaged over an 8-hour period. As used in this section, 30 micrograms per cubic meter of air" refers to the action level.
- B. **Area Monitoring:** Sampling of lead concentrations which is representative of the airborne lead concentrations which may reach the breathing zone of personnel potentially exposed to lead.
- C. **Physical Boundary:** Area physically roped or partitioned off around an enclosed lead control area to limit unauthorized entry of personnel. As used in this section, "inside boundary" shall mean the same as "outside lead control area."
- D. **Certified Industrial Hygienist (CIH):** As used in this section, refers to an Industrial Hygienist

- employed by the contractor and is certified by the American Board of Industrial Hygiene in comprehensive practice.
- E. **Change Rooms and Shower Facilities:** Rooms within the designated physical boundary around the lead control area equipped with separate storage facilities for clean protective work clothing and equipment and for street clothes which prevent cross- contamination.
 - F. **Competent Person:** A person capable of identifying lead hazards in the work area and is authorized by the contractor to take corrective action.
 - G. **Decontamination Room:** Room for removal of contaminated personal protective equipment (PPE).
 - H. **Eight-Hour Time Weighted Average (TWA):** Airborne concentration of lead averaged over an 8-hour workday to which an employee is exposed.
 - I. **High Efficiency Particulate Air (HEPA) Filter Equipment:** HEPA filtered vacuuming equipment with a UL 586 filter system capable of collecting and retaining lead-contaminated paint dust. A high efficiency particulate filter means 99.97 percent efficient against 0.3 micron size particles.
 - J. **Lead:** Metallic lead, inorganic lead compounds, and organic lead soaps. Excluded from this definition are other organic lead compounds.
 - K. **Lead-Based Paint:** Any paint or other surface coating containing lead or lead in its components in any quantity exceeding 0.5% of the total weight of the material or more than 1 milligram (0.7 milligrams in the District of Columbia) per square centimeter (mg/cm²).
 - L. **Lead Control Area:** An enclosed area or structure with full negative pressure containment to prevent the spread of lead dust, paint chips, or debris of lead-containing material removal operations. The lead control area is isolated by physical boundaries to prevent unauthorized entry of personnel.
 - M. **Lead Permissible Exposure Limit (PEL):** Fifty micrograms per cubic meter of air as an 8-hour time weighted average as determined by 29 CFR 1926.62. If an employee is exposed for more than 8 hours in a work day, the PEL shall be determined by the following formula. $PEL (\text{micrograms/cubic meter of air}) = 400/\text{No. of hrs worked per day}$
 - N. **Personnel Monitoring:** Sampling of lead concentrations within the breathing zone of an employee to determine the 8-hour time weighted average concentration in accordance with 29 CFR 1926.62. Samples shall be representative of the employee's work tasks. Breathing zone shall be considered an area within a hemisphere, forward of the shoulders, with a radius of 150 mm to 225 mm (6 to 9 inches) and the center at the nose or mouth of an employee.
 - O. **Architect:** Architect of the Capitol
 - P. **Mini-enclosure system:** A portable enclosure utilized for small scale short duration lead containing material removal projects which provides a suitable lead control area.

1.6 QUALITY ASSURANCE

- A. **Before exposure** to lead-contaminated dust, show evidence that workers have completed the comprehensive medical examination as required by 29 CFR 1926.62 (I) (1) (i) & (ii). The examination shall not be required if adequate records show that employees have been examined as required by 29 CFR 1926.62(i) within the last year.
- B. **Medical Records:** Maintain complete and accurate medical records of employees in accordance with 29 CFR 1910.20.
- C. **The Contractor** shall engage the services of an Certified Industrial Hygienist (CIH) certified by the American Board of Industrial Hygiene (ABIH). Selection of the CIH is subject to approval of the Architect. The CIH will be responsible for, but not limited to the following:
 - 1. **Certify** Training.
 - 2. **Review, approve and submit** to the Architect's representative, all lead-containing material removal plan for conformance to the applicable referenced standards.
 - 3. **Inspect and or oversee** the inspection of, all lead-containing material removal work for conformance with the approved plan.
 - 4. **Develop** a monitoring plan and/or perform the monitoring. This is to include samples to test airborne levels of lead to determine exposure.
 - 5. **Ensure work** is performed in strict accordance with specifications at all times.
 - 6. **Ensure hazardous exposure** to personnel and to the environment are adequately controlled at all times.
 - 7. **Visually inspect** all lead control areas for cleanliness and perform floor dust wipe testing.
 - 8. **Review and approve** and submit to the Architect's representative, all sampling data within the time frames outlined in this specification.
 - 9. **Review, approve and submit** to the Architect, the Contractor's lead compliance program in accordance with 29 CFR 1926.62(e)(2).
 - a. The CIH may delegate the performance of his work, (except for the reviews and approval of plans, programs and sampling strategies), to Industrial Hygienist (IH) he selects, who are qualified by virtue of their training and work experiences to perform tasks. The CIH shall supervise the IH or all of the IH (s) and will be responsible for and review all results of their work. The selection of the CIH and the IH (s), is subject to approval of the Architect.
- D. **Training:** Train each employee performing lead paint removal, lead containing material removal, disposal, and air sampling operations prior to the time of initial job assignment, in accordance with 29 CFR 1926.62.
- E. **Training Certification:** The CIH shall certify all contractor employee Lead Training Certificates. These documents shall be submitted to the Architect as directed by section 1.6.D.6.c of this specification.
- F. **Respiratory Protection Program:**
 - 1. Furnish each employee required to wear a negative pressure respirator or other appropriate

- type with a respirator fit test at the time of initial fitting and at intervals that are required by 29 CFR 1910.134.
2. The contractor shall establish and implement a respiratory protection program that has been approved and certified by the project CIH as required by 29 CFR 1910.134, 29 CFR 1910.1025, and 29 CFR 1926.62.
- G. **Hazard Communication Program:** The contractor shall establish and implement a Hazard Communication program that has been approved and certified by the project CIH as required by 29 CFR 1910.1200. Once approved by the Architect and before any work starts, the contractor shall implement this plan.
- H. **Safety and Health Compliance:**
1. **In addition** to the detailed requirements of this specification, comply with laws, ordinances, rules, and regulations of federal, state, and local authorities regarding removing, handling, storing, transporting, licensing and disposing of lead waste materials. Comply with the applicable requirements of the current issue of 29 CFR 1926.62 and this specification. Submit matters regarding interpretation of standards to the Architect for resolution before starting work.
 2. **Where specification** requirements and the referenced documents vary, the most stringent requirements shall apply.
- I. **Pre-Construction Conference:** Ten (10) days before beginning any lead containing material removal, the CIH and removal contractor shall meet with the Architect's Occupational Health, Environmental, and Safety Office representative to discuss in detail the lead-containing paint and or material removal work plan. The topic of the Pre-Construction Conference shall include work procedures and precautions for the work plan.
- J. **Supervision:** The competent person assigned to this operation by the contractor, shall be required to be onsite and supervising any and all work being performed inside the Lead Control area.

1.7 SUBMITTAL

- A. **General:** No work involving the removal of lead containing materials shall begin until all submittals required by this specification are approved by the Architect.
- B. **Hazardous Waste Management:**
1. **Submit a Hazardous Waste Management Plan** within 14 days after award of contract to the Architect for approval. The Hazardous Waste Management plan shall comply with applicable requirements of Federal, State, and local hazardous waste regulations and address:
 - a. Procedures to segregate abatement wastes into separate waste streams to minimize the quantity of hazards waste generated.
 - b. Testing to identify hazardous wastes associated with the work.
 - c. Estimated quantities of wastes to be generated and disposed of.

- d. Transporter / disposal facility documentation including, name, location, EPA identification number, hazardous waste permits and a 24 hour point of contact.
 - e. Names and qualifications (experience and training) of personnel who will be working on-site with hazardous wastes.
 - f. List of waste handling equipment to be used in performing the work, to include cleaning, volume reduction, and transport equipment.
 - g. Spill prevention, containment, and cleanup contingency measures to be implemented.
 - h. Procedures and schedule for waste containment, removal and disposal. Wastes shall be cleaned up and containerized daily.
2. **Obtain Architect's generator EPA** identification number from the Architect. Contact the Architect's Safety and Occupational Health Branch's representative for this information.
- B. **Manufacturer's Catalog Data:**
1. HEPA Vacuums
 2. Respirators
 3. HEPA filtered negative air machines.
 4. LBP Removal Chemicals.
 5. All other tools or equipment that the contractor plans on using to remove Lead - Containing materials.
- C. **Instructions:** Paint removal materials. Include applicable material safety data sheets.
- D. **Statements Certifications and Statements:**
1. **Qualifications of CIH:** Submit to the Architect for approval the name, address, and telephone number of the CIH selected to perform responsibilities in paragraph entitled "CIH Responsibilities." Provide previous experience of the CIH on five (5) projects of comparable size, cost and complexity. Submit proper documentation that the Industrial Hygienist is certified by the American Board of Industrial Hygiene in comprehensive practice, including certification number and date of certification/re-certification.
 2. **Qualifications of Competent Person:** Submit to the Architect for approval the name, address, and telephone number of the Competent Person assigned to supervise this operation. Provide all previous experience of the Competent Person related to Lead Abatement operations.
 3. **Testing Laboratory:** Submit to the Architect for approval, the name, address, and telephone number of the testing laboratory selected to performing the analysis and reporting of airborne concentrations of lead wipes, and TCLP sampling. Provide proper documentation that persons performing the analysis have been judged proficient by successful participation within the last year in the American Industrial Hygiene Association (AIHA). Environmental Lead Proficiency Analytical Testing Program (ELPAT). The laboratory shall be accredited by the American Industrial Hygiene Association (AIHA). Provide AIHA and ELPAT documentation along with date of accreditation / re-accreditation.
 4. **Lead-Containing Material Removal Plan:** Ten (10) days before work starts, submit to

the Architect for approval, a detailed job-specific plan, approved by the CIH, of work procedures to be used in the removal of lead-containing paint or materials. The plan shall include the name of the Competent Person assigned to supervise the operation, a sketch showing the location, size, and details of lead control areas, type of containment materials used, location and details of decontamination rooms, change rooms, shower facilities, and HEPA filtered mechanical ventilation system.

- a. Include in the plan, eating, drinking, smoking and restroom procedures, interface of trades, sequencing of lead related work, collected wastewater and lead paint and/or lead containing material debris disposal plan, air sampling plan, respirators, protective equipment, and a detailed description of the method of containment of the operation to ensure that airborne lead concentrations of 30 micrograms per cubic meter of air are not exceeded outside of the lead control area.
 - b. Include air and floor wipe sampling, strategy, sampling methodology, frequency, duration of sampling, and qualifications and training of air monitoring personnel in the sampling portion on the plan.
5. **Field Test Reports:** Monitoring Results: Submit all monitoring results to the Architect's Occupational Health, Environmental, and Safety Office representative, by the next work day. All monitoring and floor wipe test results shall be signed by the testing laboratory, the employee performing the sampling, the employee that analyzed the sample, and the CIH. The quickest turn around time available, shall be used for all floor wipe tests, taken to clear a lead control area.
6. **Records:**
 - a. Submit completed and signed hazardous waste manifest from treatment or disposal facility.
 - b. Before work starts, submit to the Architect for approval, certification of Medical Examinations as required by 29 CFR 1926.62. The CIH shall certify that all employees, who will be engaged in lead - containing material removal operations, have been medically cleared as required by 29 CFR 1926.62.
 - c. Before work starts, submit to the Architect for approval, certification of employee training certified by the CIH.
 - d. Before work starts, submit to the Architect for approval, the CIH approved, the contractor's employee respiratory protection program.
 - e. Before work starts, submit to the Architect for approval, certification of employees respirator fit testing certified by the CIH.
 - f. Before work starts, submit to the Architect for approval, the CIH approved copy of the Hazard Communication Program as required by 29 CFR 1910.1200.
 - g. Before work starts, submit to the Architect for approval, the Contractor's CIH approved lead compliance program in accordance with 29 CFR 1926.62(e)(2).
 - h. Three days after completion of each containment and or lead abatement activity, submit a draft closing report. The closing report shall include a executive summary which will include but is not limited to the following: (1) A statement of the work done, (2) Address all issues concerning all documents generated during this activity (See a through g above), (3) A statement that the work area is cleared for re-occupancy, any other comments related to this work activity or is requested by the

AOC. Two days after all comments are received on the draft closing report, submit the final closing report.

PART 2 PRODUCTS

2.1 PAINT REMOVAL PRODUCTS:

- A. **Submit for approval**, applicable Material Safety Data Sheets for paint removal products used in paint removal work. Use the least toxic, low-odor product, suitable for the job and acceptable to the CIH.

PART 3 EXECUTION

3.1 PROTECTION FOR SMALL SCALE PROJECTS - Incidental activities such as channeling, drilling, and minor demolition of walls, ceilings, and floors where lead containing materials are impacted.

- A. **Notification:** Notify the Architect's Occupational Health, Environmental, and Safety Office representative 10 days prior to the start of any lead abatement work.
- B. **Lead Control Area Requirements:**
 - 1. **Establish a lead control area** by utilizing a mini-enclosure system.
 - 2. **Contain lead material** impacted through the use of negative pressure, HEPA filtered vacuums, wetting methods, use of low-odor solvents, needle guns, and/or heat guns.
- C. **Protection of Existing Work to Remain:** Perform Lead - Containing Material removal work without damage or contamination of adjacent areas. Where existing work is damaged or contaminated, the contractor will restore it to its original condition.
- D. **Boundary Requirements:** Provide tape barrier to cordon off lead control area.
- E. **Heating, Ventilating and Air Conditioning (HVAC) Systems:** Seal or modify vents, diffusers, ducts, etc., with plastic to prevent air movement through lead control area.
- F. **Change Room and Shower Facilities:** Change rooms and shower facilities within the physical boundary around the designated lead control area shall be addressed according to the requirements of 29 CFR 1926.62 and the approved Lead Containing Material Removal Plan.
- G. **Mechanical Ventilation System:**
 - 1. **Use adequate ventilation** to control personnel exposure to lead in accordance with 29 CFR 1926.62.
 - 2. **Contain lead material** impacted through the use of negative pressure, HEPA filtered vacuums, wetting methods, use of low-odor solvents, needle guns, and/or heat guns.
- H. **Personnel Protection:** Personnel shall wear and use protective clothing and equipment as specified herein. Eating, smoking, or drinking is not permitted in the lead control area. The CIH

shall initially select the appropriate respiratory protection to be used by the employees as required by 29 CFR 1926.62.

- I. **Warning Signs:** Provide warning signs at approaches to lead control areas. Locate signs at such a distance that personnel may read the sign and take the necessary precautions before entering the area. Signs shall comply with the requirements of 29 CFR 1926.62.

3.2 WORK PROCEDURES

- A. **Perform removal of Lead-Containing Material** in accordance with approved Lead-Containing Material removal plan. The assigned Competent Person shall supervise the work and will be on site anytime work in the Lead Control area is on-going. This person shall use procedures and equipment required to limit occupational and environmental exposure to lead when Lead - Containing Material is removed in accordance with 29 CFR 1926.62, except as specified herein. Dispose of removed Lead-Containing Material, any paint chips and associated waste in compliance with Environmental Protection Agency (EPA), federal, state, and local requirements.
- B. **Personnel Exiting Procedures:** Whenever personnel exit the lead-controlled area, they shall perform the following procedures and shall not leave the work until:
 1. **Vacuum** themselves off.
 2. **Remove protective clothing** in the decontamination room, and place them in an approved impermeable disposal bag.
 3. **Shower**, if required by Lead Containing Material Removal Plan.
 4. **Change** to clean clothes prior to leaving the physical boundary designated around the lead-contaminated job site.
- C. **Monitoring:** Monitoring of airborne concentrations of lead shall be in accordance with 29 CFR 1926.62 and as specified herein. Air monitoring, testing, and reporting shall be performed by a CIH or an Industrial Hygiene (IH) Technician who is under the direction of the CIH.
 1. **The CIH or the IH Technician** under the direction of the CIH shall be on the job site directing the monitoring, and inspecting the Lead - Containing Material removal work to ensure that the requirements of this specification have been satisfied during the entire Lead - Containing Material removal operation.
 2. **Personal air monitoring samples** shall be taken on employees who are anticipated to have the greatest risk of exposure as determined by the CIH.
 3. **Submit results of air monitoring samples**, signed by the CIH, by the next work day after the air samples are taken. Notify the Architect immediately of exposure to lead at or in excess of the action level of 30 micrograms per cubic meter of air outside of the lead control area.
- D. **Monitoring During Lead-Containing Material Removal Work:**
 1. **Perform personal and area monitoring** during the entire Lead-Containing Material removal operation. Sufficient area monitoring shall be conducted at the physical boundary outside the lead control area to ensure unprotected personnel are not exposed

above 20 micrograms per cubic meter of air.

- a. If the outside boundary lead levels are at or exceed 20 micrograms per cubic meter of air, work shall be stopped and the CIH shall notify the Architect immediately.
 - 1) The CIH shall immediately investigate, perform necessary air and/or wipe sampling and render a decision as whether these areas are contaminated are not. The findings of the investigation and the results of any samples taken, shall be reported to the Architect immediately.
 - 2) If the area investigated by the CIH is found to be contaminated with lead, the following procedures shall be followed:
 - a) Work in all lead containment operations shall remain halted.
 - b) The contractor shall decontaminate (clean up) the contaminated area.
 - c) The CIH shall determine the source and cause of the contamination, along with the necessary corrective measures to be taken.
 - d) The contractor shall decontaminate the contaminated area using the corrective measures outlined by the CIH.
 - e) The CIH shall visually inspect the “contractor cleaned” contaminated area and perform floor wipe tests. The number of floor wipe tests will be determined by the CIH. Results of the floor wipe tests shall be less than 40 $\mu\text{g}/\text{ft}^2$. The CIH shall submit copies of all sample results along with a certification that the area is no longer contaminated with lead.
 - f) If on the second try, the contractor is unable to achieve a floor wipe sample result of less than 40 $\mu\text{g}/\text{ft}^2$ for a particular area, the following procedures shall be followed:
 1. The CIH shall render a decision as to what clearance level would be achievable for that particular area.
 2. The CIH shall submit to the Architect this decision, along with copies of the sampling data for area, along with a certification that the area is no longer contaminated with lead.
 - g) The Architect will issue the authority to restart work in the lead control area, once the CIH certifies to the Architect, that the contaminated area has been successfully decontaminated.
 2. **The CIH** shall review the sampling data collected on that day to determine if condition(s) requires any further change in work methods. Removal work shall resume when approval is given by the Architect.
 3. **The Contractor** shall control the lead level outside of the work boundary to less than 30 micrograms per cubic meter of air at all times. As a minimum, conduct area monitoring daily on each shift in which Lead - Containing Material removal operations are performed in areas immediately adjacent to the lead control area. If any outside the work boundary lead levels are at or exceed 20 micrograms per cubic meter of air, work shall be stopped and the CIH shall immediately investigate as to what condition(s) are causing the increased levels and notify the Architect

immediately. Removal work shall resume when approval is given by the Architect.

3.3 LEAD-CONTAINING MATERIAL REMOVAL

- A. **Remove Lead - Containing Material** within the areas designated on the approved Lead - Containing Material Removal Plan in order to completely expose the substrate. Take whatever precautions are necessary to minimize damage to the underlying substrate.
- B. **Indoor Lead-Containing Material Removal:** Select Lead - Containing Material removal processes to minimize contamination of work areas with lead-contaminated dust or other lead-contaminated debris/waste. This Lead - Containing Material removal process shall be described in the Lead - Containing Material removal plan approved by the Architect.
- C. **After beginning the Lead-Containing Material** removal operation or at the direction of the Architect, the following procedures shall be followed, concerning all reports of possible lead contamination in occupied spaces, within a building that has a Lead Control area:
 - 1. **The CIH** shall immediately investigate, perform necessary air and/or wipe sampling and render a decision as whether these areas are contaminated and develop a corrective plan of action. The findings of the investigation and the results of any samples taken, shall be reported to the Architect immediately.
 - 2. **If the area investigated** by the CIH is found to be contaminated with lead, the following procedures shall be followed:
 - a. Work in all lead containment operations shall be halted.
 - b. The contractor shall initiate the corrective plan of action plan developed by the CIH in order to decontaminate the area.
 - c. The CIH shall determine the source and cause of the contamination, along with the necessary corrective measures to be taken to prevent a reoccurrence.
 - d. Before any lead abatement work is restarted, the CIH must certify to the Architect, that the source and cause of the contamination has been corrected. Work may restart once approval from the Architect is received.
 - e. The CIH shall visually inspect the “contractor cleaned” contaminated area and perform floor wipe tests. The number of floor wipe tests will be determined by the CIH. Results of the floor wipe tests shall be less than 40 µg/ft². The CIH shall submit copies of all sample results along with a certification that the area is no longer contaminated with lead.
 - 3. If after the second try, the Contractor is unable to achieve a floor wipe sample result of less than 100 micrograms per square foot for a particular area, the following procedures shall be followed:
 - a. The CIH shall render a decision as to what clearance level would be achievable for that particular control area.
 - b. The CIH shall submit to the Architect this decision, along with copies of the sampling data for area, along with a certification that the area is no longer contaminated with lead.

3.4 CLEANUP AND DISPOSAL:

- A. **Cleanup:** Maintain surfaces of the lead control area free of accumulations of Lead - Containing Material chips and dust. Restrict the spread of dust and debris; keep waste from being distributed over the work area. Do not dry sweep or use compressed air to clean up the area. At the end of each shift and when the Lead - Containing Material removal operation has been completed, clean the area of all visible Lead - Containing Material contamination, dust and debris by vacuuming with a HEPA filtered vacuum cleaner and wet wipe and or mopping the area.
- B. **Certification:** The CIH shall certify in writing the following:
1. **The inside and outside** of each lead control area air monitoring samples are less than 30 micrograms per cubic meter of air.
 2. **The respiratory protection** for the employees was adequate and the work procedures were performed in accordance with 29 CFR 1926.62 and this specification, and that there were no visible accumulations of lead-contaminated Lead - Containing Material and dust on the work site.
 3. **The CIH** shall perform floor wipe test(s) by using methodology that is outlined in HUD's Guidelines for the Evaluation and Control of Lead - Based Paint hazards in Housing. A Lead Control area is considered complete if all floor wipe sample results are below 100 micrograms per square foot. Do not remove the lead control area or roped-off boundary and warning signs prior to the Architect's approval and receipt of the CIH's certification.
 4. **Re-clean and re-sample** any Lead Control area showing dust or residual Lead - Containing Material (chips) or floor wipe sample results that are above 100 micrograms per square foot.
 5. **If after the second attempt**, the Contractor is unable to achieve a floor wipe sample result of less than 100 micrograms per square foot for a particular lead control area, the following procedures shall be followed:
 - a. The CIH shall render a decision as to what clearance level would be achievable for that particular control area.
 - b. The CIH shall submit to the Architect this decision, along with copies of the sampling data for containment removal approval.
 - c. The Architect may have the CIH's decision reviewed by a third party CIH.
- C. **Testing of Lead-Containing Material Residue:** Where indicated or when directed by the Architect, test all potential Lead - Containing waste by following the Toxicity Characteristic Leaching Procedure (TCLP) for lead in accordance with 40 CFR 261.
- D. **Disposal:**
1. **Collect** all potential lead-contaminated waste, including but not limited to, removed paint chips, abrasive blast medium, architectural components, scrap, debris, bags, containers, equipment, and lead-contaminated clothing.
 2. **For drummed waste**, store in U.S. Department of Transportation (49 CFR 178) approved 55-gallon drums to identify the type of waste (49 CFR 172) and the date lead contaminated wastes were first put into the drum. Comply with labeling, marking, and

placarding requirements described in 49 CFR 173.

For architectural components, e.g., doors, windows, and molding, store so as to prevent environmental contamination. Six - mil plastic sheeting should be placed underneath and on top of the material; plywood or other durable material should be placed on top of the plastic to prevent it from being punctured. Transport waste in covered vehicle only.

3. **Periodically remove hazardous wastes** so that 90 calendar day storage limitation is not exceeded.
4. **Handle, store, transport, and dispose** lead or lead-contaminated waste in accordance with 40 CFR 260, 40 CFR 261, 40 CFR 262, 40 CFR 263, 40 CFR 264, and 40 CFR 265. Comply with land disposal restriction notification requirements as required by 40 CFR 268.
5. **Disposal Documentation:** Submit written evidence that the hazardous waste transporter and the treatment, storage, or disposal facility (TSDF) is approved for lead disposal by the EPA and state or local regulatory agencies. Submit one copy of the completed manifest, signed and dated by the initial transporter in accordance with 40 CFR 262. Submit Certification of disposal from TSDF.

END OF SECTION 13282

SECTION 15050 - BASIC MECHANICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Piping materials and installation instructions common to most piping systems.
 - 2. Transition fittings.
 - 3. Dielectric fittings.
 - 4. Mechanical sleeve seals.
 - 5. Sleeves.
 - 6. Escutcheons.
 - 7. Grout.
 - 8. Mechanical demolition.
 - 9. Equipment installation requirements common to equipment sections.
 - 10. Painting and finishing.
 - 11. Concrete bases.
 - 12. Supports and anchorages.
 - 13. Piping tests.

1.3 REFERENCED STANDARDS

- A. American Society for Testing and Materials
 - 1. ASTM A 53: Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
 - 2. ASTM B 32: Specification for Solder Metal
 - 3. ASTM B 813: Specification for Liquid and Paste Fluxes for Soldering Applications of Copper and Copper Alloy Tube
 - 4. ASTM B 828: Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings
 - 5. ASTM C 1007: Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
 - 6. ASTM C 1173: Specification for Flexible Transition Couplings for Underground Piping Systems
- B. American Water Works Association
 - 1. AWWA C110: Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In. (76 mm through 1219 mm), for Water and Other Liquids
 - 2. AWWA C219: Bolted, Sleeve-Type Couplings for Plain-End Pipe

- C. American Welding Society
 - 1. AWS A5.8: Specification for Filler Metals for Brazing and Braze Welding
 - 2. AWS D1.1: Structural Welding Code - Steel
 - 3. AWS D10.12: Recommended Practices and Procedures for Welding Low Carbon Steel Pipe
 - 4. Brazing Handbook
- D. ASME International
 - 1. ASME B1.20 (Reaffirmed 1992): Pipe Threads, General Purpose (Inch)
 - 2. ASME B16.21: Nonmetallic Flat Gaskets for Pipe Flanges
 - 3. ASME B18.2.1: Square and Hex Bolts and Screws-Inch Series
 - 4. ASME B31 Series: Code for Pressure Piping
 - 5. ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications"
- E. Copper Development Association Inc.
 - 1. Copper Tube Handbook
- F. Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.
 - 1. MSS SP-107: Transition Union Fittings for Joining Metal and Plastic Products.

1.4 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.
- F. The following are industry abbreviations for rubber materials:
 - 1. EPDM: Ethylene-propylene-diene terpolymer rubber.
 - 2. NBR: Acrylonitrile-butadiene rubber.

1.5 SUBMITTALS

A. Product Data: For the following:

1. Transition fittings.
2. Dielectric fittings.
3. Mechanical sleeve seals.
4. Escutcheons.

B. Coordination drawings: For each item of equipment for which lockout/tagout procedures are required for service, submit a coordination drawing showing how maintenance personnel will have access for the procedures. Coordination drawing for each item of equipment shall be approved before installation of that item of equipment begins.

C. Informational Submittals: Submit following:

1. Coordination Drawings: For access panel and door locations.
2. Detail major elements, components, and systems of Division 15 mechanical equipment and materials in relationship with other systems, including related sections of Divisions 13 and 16; installations, and building components. Show space requirements for installation and access. Indicate if sequence and coordination of installations are important to efficient flow of Work. Include following:
 - a. Planned piping layout, including valve and specialty locations and valve-stem movement.
 - b. Clearances for installing and maintaining insulation.
 - c. Clearances for servicing and maintaining equipment, accessories, and specialties, including space for disassembly required for periodic maintenance.
 - d. Equipment and accessory service connections and support details.
 - e. Exterior wall and foundation penetrations.
 - f. Fire-rated wall and floor penetrations.
 - g. Sizes and location of required concrete pads and bases.
 - h. Scheduling, sequencing, movement, and positioning of large equipment into building during construction.
 - i. Floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.
 - j. Reflected ceiling plans to coordinate and integrate installation of air outlets and inlets, light fixtures, communication system components, sprinklers, and other ceiling-mounted items.

D. Welding Documentation.

1. Certifications: Proof of operator and testing agency personnel qualifications as required for welding and brazing in the article "Quality Assurance" below.
2. Schedule of welding and brazing procedures proposed for each piping system included in the project.

- E. Test reports: Field test results for each piping system as specified in Part 3 below.

1.6 QUALITY ASSURANCE

- A. Steel Support Welding: Qualify processes and operators according to the following:
 - 1. AWS D1.1, "Structural Welding Code--Steel."
 - 2. AWS D2.3, "Structural Welding Code--Sheet Steel."
 - 3. AWS D1.4, "Structural Welding Code--Reinforcing Steel."
- B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
 - 1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
 - 2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.
- C. Copper Pipe Brazing and Soldering: Qualify processes and operators according to the following:
 - 1. ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
 - 2. AWS B2.2, "Standard for Brazing Procedure and Performance Qualification."
 - 3. Copper Development Association "Copper Tube Handbook."
 - 4. Safe Drinking Water Act.
- D. Qualifications of independent testing laboratory personnel:
 - 1. Welding inspectors: AWS QC1, Certification of AWS level 3 qualified Welding Inspectors.
- E. Electrical Characteristics for Mechanical Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

1.8 COORDINATION

- A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for mechanical installations.

- B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- C. Coordinate requirements for access panels and doors for mechanical items requiring access that are concealed behind finished surfaces.

PART 2 - PRODUCTS

2.1 PIPE, TUBE, AND FITTINGS

- A. Refer to individual Division 15 piping Sections for pipe, tube, and fitting materials and joining methods.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.2 JOINING MATERIALS

- A. Refer to individual Division 15 piping Sections for special joining materials not listed below.
- B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
 - 1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch (3.2-mm) maximum thickness unless thickness or specific material is indicated.
 - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
 - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
 - 2. AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.
- C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- D. Solder Filler Metals: ASTM B 32, lead-free alloy solder. Include water-flushable, lead-free flux according to ASTM B 813.
- E. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.
- F. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.3 TRANSITION FITTINGS

- A. AWWA Transition Couplings: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.

1. Underground Piping NPS 1-1/2DN 40 and Smaller: Manufactured fitting or coupling.
 2. Underground Piping NPS 2DN 50 and Larger: AWWA C219, metal sleeve-type coupling.
 3. Aboveground Pressure Piping: Pipe fitting.
- B. Flexible Transition Couplings for Underground Nonpressure Drainage Piping: ASTM C 1173 with elastomeric sleeve, ends same size as piping to be joined, and corrosion-resistant metal band on each end.

2.4 DIELECTRIC FITTINGS

- A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.
- B. Insulating Material: Suitable for system fluid, pressure, and temperature.
- C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig (1725-kPa) minimum working pressure at 180 deg F (82 deg C).
- D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig (1035- or 2070-kPa) minimum working pressure as required to suit system pressures.
- E. Dielectric-Flange Kits: Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
1. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig (1035- or 2070-kPa) minimum working pressure where required to suit system pressures.
- F. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).
- G. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).

2.5 MECHANICAL SLEEVE SEALS

- A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
1. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 2. Pressure Plates: Stainless steel. Include two for each sealing element.

3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.6 SLEEVES

- A. Galvanized-Steel Sheet Sleeves: 24 gauge (0.67-mm) minimum thickness; round tube closed with welded longitudinal joint.
- B. Steel Pipe Sleeves: ASTM A 53, Type E, Grade B, Schedule 40, plain ends.
- C. Copper Pipe Sleeves: Type L, ASTM B88, hard drawn.
- D. Cast Iron Sleeves: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

2.7 ESCUTCHEONS

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
- B. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.
 1. Finish: Polished chrome-plated.
- C. Split-Plate, Stamped-Brass Type: With concealed hinge, set screw, and chrome-plated finish.
- D. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.

2.8 GROUT

- A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
 1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
 2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
 3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 MECHANICAL DEMOLITION

- A. Refer to Division 1 Section "Selective Demolition" for general demolition requirements and procedures.

- B. Disconnect, demolish, and remove mechanical systems, equipment, and components indicated to be removed.
 - 1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
 - 2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
 - 3. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
 - 4. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material.
 - 5. Equipment to Be Removed: Disconnect and cap services and remove equipment.
 - 6. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
 - 7. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
- C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.2 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Install piping according to the following requirements and Division 15 Sections specifying piping systems.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping to permit valve servicing.
- G. Install piping at indicated slopes.
- H. Install piping free of sags and bends.
- I. Install fittings for changes in direction and branch connections.

- J. Install piping to allow application of insulation.
- K. Select system components with pressure rating equal to or greater than system operating pressure.
- L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:
 - 1. New Piping: Piping passing through interior walls, partitions, floors, and ceilings in exposed locations shall be fitted with wall, floor, and ceiling escutcheons of size and depth to conceal sleeves. Secure escutcheons firmly in place with set screws.
 - 2. Existing Piping: Piping passing through interior walls, partitions, floors, and ceilings in exposed locations shall be fitted with wall, floor, and ceiling escutcheons of size and depth to conceal sleeves. Secure escutcheons firmly in place with set screws.
- M. Sleeves are not required for core-drilled holes.
- N. Sleeves are not required where steel pipe penetrates beam that is not part of a fire- or smoke-rated assembly.
- O. Do not cut, drill, or burn structural steel for installation of piping without specific written instructions from the Architect.
- P. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
 - 1. Use the following sleeve materials in nonfire-rated construction.
 - a. Install steel sleeves for penetrations of steel, iron, and insulated piping. Galvanized-steel sheet sleeves may be used for piping penetrating gypsum-board partitions.
 - b. Install copper sleeves for penetrations of uninsulated copper tubing and piping.
 - c. Install stack sleeve fittings for pipes penetrating floors with membrane waterproofing.
 - 2. Sleeves used in piping penetrations through fire-rated construction shall be an acceptable component of the through-penetration firestop assembly.
 - a. Where firestop assembly is UL listed, sleeve material shall be as directed in the listing.
 - b. Where other specified approval and acceptance is required, sleeve shall be as described in the approved assembly.
 - 3. Install sleeves through walls and partitions flush with finished surfaces.
 - 4. Sleeves through floors shall extend 0.375 inch (10 mm) above top of finished floor and be finished neat and level. Sleeves through mechanical or equipment room floors shall extend 1.0 inch (25 mm) above finished floor. Provide projecting

- sleeves with anchor clips to prevent them from being loosened and knocked down in the floor construction.
5. Sleeves for insulated piping with vapor barrier shall be sized large enough to pass piping and insulation.
 6. Seal spaces between sleeves and pipe, or pipe insulation, in nonrated walls, with mineral wool.
- Q. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
1. Install cast-iron sleeves in exterior wall.
 2. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- R. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron sleeves in exterior wall. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
 2. Provide mechanical sleeve seals at outside and inside faces of wall where water conditions exist.
- S. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 7 Section "Through-Penetration Firestop Systems" for materials.
- T. Coordinate and verify final equipment locations for roughing-in.
- U. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.3 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 15 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

- D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
- F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
- H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

3.4 PIPING CONNECTIONS

- A. Make connections according to the following, unless otherwise indicated:
 - 1. Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment.
 - 2. Install flanges, in piping NPS 2-1/2 (DN 65) and larger, adjacent to flanged valves and at final connection to each piece of equipment.
 - 3. Install dielectric couplings or dielectric nipple fittings to connect piping materials of dissimilar metals.

3.5 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. Install mechanical equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
 - 1. For each item of equipment for which lockout/tagout procedures are required for service, do not begin installation until coordination drawings for installation have been approved, as required in "Submittals" in Part 1 above.

- D. Install equipment to allow right of way for piping installed at required slope.

3.6 PAINTING

- A. Painting of mechanical systems, equipment, and components is specified in Division 9 Section "Painting."
- B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.7 CONCRETE BASES

- A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.
 - 1. Construct concrete bases of dimensions indicated, but not less than 4 inches 100 mm larger in both directions than supported unit.
 - 2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of the base.
 - 3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
 - 4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 5. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - 6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
 - 7. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete and reinforcement as specified in Division 3 Section "Cast-in-Place Concrete (Limited Applications)."

3.8 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.
- B. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.9 GROUTING

- A. Mix and install grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors.
- B. Clean surfaces that will come into contact with grout.
- C. Provide forms as required for placement of grout.
- D. Avoid air entrapment during placement of grout.
- E. Place grout, completely filling equipment bases.
- F. Place grout on concrete bases and provide smooth bearing surface for equipment.
- G. Place grout around anchors.
- H. Cure placed grout.

3.10 PIPING TESTS

- A. Notify Government at least one day prior to the actual test.
- B. Test before pipes are concealed or insulated. Test the piping in sections as the work progresses, so as not to delay progress of the building construction. Furnish pumps and gauges required for testing.
- C. Conduct piping tests before connecting equipment that would be subject to damage from the test pressure. Replace piping or fittings found defective with new material.
- D. Bracing and supporting: Adequately brace and support piping during the test, so that no movement, displacement, or damage results from the application of the test pressure.
- E. Test the piping systems for not less than four hours to fulfill the conditions in the Piping Systems Test Schedule at the end of this section.
- F. Documentation of Tests: Prepare a test report for each portion of piping tested, identified by service, material, location, and pipe size. Include these items:
 - 1. Date of test.
 - 2. Starting and completion items.
 - 3. Initial test pressure.
 - 4. Final test pressure.
 - 5. Problems or leaks detected.
 - 6. Corrective actions taken.
 - 7. Record of successful completion of testing.
 - 8. Name, title, and signature of person conducting test.
- G. Test exterior gravity sanitary and storm sewer piping by the exfiltration method. Backfill over sewers to a minimum depth of two feet of cover prior to tests. Plug the lower manhole,

filling the section between manholes with water and measuring the drop in water level in the upper manhole. Furnish water for testing, and maintain it at levels directed by the Architect, for a period of at least 24 hours. Repair or replace all visible leaks and all defects to meet the maximum allowable leakage shown in the Sewer Piping Test Schedule at the end of this section.

H. Interior sanitary and storm drainage piping:

1. Before connection of the plumbing fixtures and before connection to the sewer, cap or plug the entire sanitary, condensate, and storm drainage piping systems of the building.
2. Test following the methods of testing required by the International Plumbing Code, and no less than the duration and pressures required in the Schedule of Piping Systems Tests.
3. Where pipes are in trenches, leave the trenches open until the completion of the test.

I. When a domestic water loop is completed, and before strainer baskets are installed, pressure test at the pressure shown in Piping Systems Test Schedule, and thoroughly flush. Water piping connections for flushing shall be same size as piping being flushed or one size smaller. When a major section of the building is completed, repeat the same procedure, except that water pipe connections for flushing shall be limited to NPS 1.5 (DN 40). Then install strainer baskets and conduct a preliminary operation test.

J. Perform the following tests on hydronic piping according to ASME B31.9 Hydrostatic Leak Testing, and as follows:

1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
2. While filling system, use vents installed at high points of system to release trapped air. Use drains installed at low points for complete draining of liquid.
3. Check expansion tanks to determine that they are not air bound and that system is full of water.
4. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the design pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed either 90 percent of specified minimum yield strength or 1.7 times "SE" value in Appendix A of ASME B31.9, "Building Services Piping."
5. After hydrostatic test pressure has been applied for at least 60 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.
6. Prepare written report of testing.

3.11 SCHEDULES

A. Piping Systems Test Schedule:

SYSTEM	TEST PRESSURE PSIG (kPa)	ALLOWABLE DROP	MEDIUM
Domestic water service and exterior water piping	150 (1030)	None	Water
Domestic water, cold & hot, and recirculated	125 (860)	None	Water
Air conditioning condensate drain	4.3 (30)	None	Water
Sanitary waste	4.3 (30)	None	Water
Fuel oil for diesel-engine generators	225 (1560)	None	*Nitrogen
Diesel exhaust	50 (350)	None	*Air

* If pressure drops, locate leaks with soap and water solution

END OF SECTION 15050

SECTION 15055 - MOTORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes basic requirements for factory- and field-installed motors, including motor drives and capacitors.
- B. Related Sections:
 - 1. Division 15 Section "Mechanical Vibration Controls" for mounting motors and vibration isolation devices.
- C. Products furnished but not installed under this Section:
 - 1. Motor Capacitors: Division 16 Section "Basic Electrical Materials and Methods."

1.3 REFERENCED STANDARDS

- A. Code of Federal Regulations
 - 1. 29 CFR - Labor, Chapter XVII - Occupational Safety and Health Administration, Department of Labor, Part 1910 - "Occupational Safety and Health Standards," Subpart B - "Regulations Relating to Labor," Section 1910.7 - "Definition and Requirements for a Nationally Recognized Testing Laboratory."
- B. International Electrical Testing Association
 - 1. NETA ATS: Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems
- C. National Electrical Manufacturers Association
 - 1. NEMA MG 1: Motors and Generators
 - 2. NEMA MG10: Energy Management Guide for Selection and Use of Polyphase Motors.
 - 3. NEMA MG 11: Energy Management Guide for Selection and Use of Single-Phase Motors.
- D. National Fire Protection Association
 - 1. NFPA 70: National Electrical Code

E. Underwriters Laboratories

1. UL 508: Industrial Control Equipment

1.4 DEFINITIONS

- A. Factory-Installed Motor: A motor installed by motorized-equipment manufacturer as a component of equipment.
- B. Field-Installed Motor: A motor installed at Project site and not factory installed as an integral component of motorized equipment.
- C. Premium efficiency motor: Motor meeting the nominal efficiency level listed for its horsepower and speed in Table 12-12 of NEMA MG 1.

1.5 SUBMITTALS

- A. Product Data:
1. Motors and drives not provided with equipment: For each type and size of motor, provide nameplate data and ratings; shipping, installed, and operating weights; motor drive type and size; enclosure type and mounting arrangements; size, type, and location of winding terminations; conduit entry and ground lug locations; and information on coatings or finishes. Provide product data which verifies compliance with ASHRAE 90.1 or provide certified performance ratings by a qualified independent testing agency.
 2. Motor capacitors.
- B. Shop Drawings for Field-Installed Motors: Dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Include the following:
1. Each installed unit's type and details.
 2. Nameplate legends.
 3. Diagrams of power, signal, and control wiring. Provide schematic wiring diagram for each type of motor and for each control scheme.
- C. Certifications: Actual motor power factor for each motor, certified test results for each motor proposed for use on this project.
- D. Qualification Data: For testing agency.
- E. Source quality-control test reports.
- F. Field quality-control test reports.

- G. Maintenance Data: For field-installed motors to include in maintenance manuals specified in Division 1.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
 - 1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.
- B. Source Limitations: Obtain field-installed motors through one source from a single manufacturer.
- C. Product Options for Field-Installed Motors: Drawings indicate size, profiles, and dimensional requirements of motors and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."
- D. HVAC equipment shall meet the energy performance requirements of ASHRAE 90.1
- E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- F. Comply with NFPA 70, NEMA MG 1.

1.7 COORDINATION

- A. Coordinate features of motors, installed units, and accessory devices and features for each motor as indicated on the drawings that comply with the following:
 - 1. Compatible with the following as indicated:
 - a. Magnetic controllers.
 - b. Multispeed controllers.
 - c. Reduced-voltage controllers.
 - 2. Designed and labeled for use as indicated with variable frequency controllers, and suitable for use throughout speed range without overheating.
 - 3. Matched to torque and horsepower requirements of the load.
 - 4. Matched to ratings and characteristics of supply circuit and required control sequence.

- B. Coordinate motor support with requirements for driven load; access for maintenance and motor replacement; installation of accessories, belts, belt guards; and adjustment of sliding rails for belt tensioning.
- C. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 3.

PART 2 - PRODUCTS

2.1 MOTOR REQUIREMENTS

- A. Motor requirements apply to factory- and field-installed motors except as follows:
 - 1. Different ratings, performance, or characteristics for motor are specified in another Section.
 - 2. Motorized-equipment manufacturer requires ratings, performance, or characteristics, other than those specified in this Section, to meet performance specified.

2.2 MOTOR CHARACTERISTICS

- A. Motors 1/2.HP and Larger: Three phase unless otherwise indicated.
- B. Motors Smaller Than 1/2. HP: Single phase unless otherwise indicated.
- C. Frequency Rating: 60 Hz.
- D. Voltage Rating: NEMA standard voltage selected to operate on nominal circuit voltage to which motor is connected.
- E. Service Factor: 1.15 for open dripproof motors; 1.0 for totally enclosed motors.
- F. Duty: Continuous duty at ambient temperature of 105 deg F (40 deg C) and at altitude of 3300 feet (1005 m) above sea level.
- G. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.
- H. Two-speed motors shall be dual winding type.
- I. Enclosure:
 - 1. Motors for equipment mounted indoors, unless specified otherwise in the equipment section, shall be open drip-proof NEMA design B construction.
 - 2. Motors for equipment mounted outdoors, and, where indicated or specified, shall be totally enclosed, fan-cooled (TEFC) extra-severe duty. Motors inside weather-tight enclosures may be open drip-proof type.

2.3 POLYPHASE MOTORS

- A. Description: NEMA MG 1, Design B, medium induction motor.
- B. Efficiency: Premium, as defined in NEMA MG 1.
- C. Stator: Copper windings.
- D. Rotor: Squirrel cage.
- E. Bearings: Double-shielded, grease prelubricated ball bearings suitable for radial and thrust loading.
- F. Temperature Rise: Match insulation rating with maximum Class B rise.
- G. Insulation: Class F.
- H. Noise rating: Quiet.
- I. Enclosure: Cast iron or rolled steel with industrial enamel paint finish and plated external hardware to resist corrosion.
- J. Horsepower/frame relationship: NEMA Standard for T frame motors.
- K. Conduit box: Either steel or aluminum, diagonally split and rotatable in 90-degree increments, with grounding provision.
- L. Nameplates: Stainless steel or aluminum, and stamped in accordance with NEMA MG1. Nameplate information shall include the nominal efficiency value in accordance with NEMA MG1 and the manufacturer's minimum guaranteed efficiency value.

2.4 TOTALLY ENCLOSED FAN-COOLED (TEFC) MOTORS

- A. Polyphase motors with the following additional requirements:
 - 1. TEFC construction for severe environment.
 - 2. Ventilating fans: Made of corrosion-resistant, non-sparking material.
 - 3. Conduit box: Heavy-wall cast construction, gasketed with a lead gasket between box and motor frame.
 - 4. Motor shaft shall be provided with an external slinger on the drive end.
 - 5. Rotor and stator air-gap surfaces coated to prevent corrosion.
 - 6. Finish: At least two coats of catalyzed epoxy enamel.

2.5 SINGLE-PHASE MOTORS

- A. Type: One of the following, to suit starting torque and requirements of specific motor application:

1. Permanent-split capacitor.
 2. Split-phase start, capacitor run.
 3. Capacitor start, capacitor run.
- B. Shaded-Pole Motors: For motors 1/20 hp and smaller only.
- C. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.
- D. Bearings: Ball type for belt-connected motors and other motors with high radial forces on motor shaft; sealed, prelubricated-sleeve type for other single-phase motors.
- E. Source Quality Control for Field-Installed Motors: Perform the following tests on each motor according to NEMA MG 1:
1. Measure winding resistance.
 2. Read no-load current and speed at rated voltage and frequency.
 3. Measure locked rotor current at rated frequency.
 4. Perform high-potential test.

2.6 MOTOR DRIVES

- A. Motors for belt-driven units shall have adjustable variably pitched cast-iron sheaves to allow a 10 percent increase or reduction in speed. Belts shall be sized for minimum 150 percent BHP. Provide OSHA-approved type belt guards. Include one change in drive sheave for each unit if necessary to obtain required air quantities and static pressure.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas to receive field-installed motors for compliance with requirements, installation tolerances, and other conditions affecting performance.
- B. Examine roughing-in for conduit systems to verify actual locations of conduit connections before motor installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FIELD-INSTALLED MOTOR INSTALLATION

- A. Anchor each motor assembly to base, adjustable rails, or other support, arranged and sized according to manufacturer's written instructions. Attach by bolting. Level and align with load transfer link.
- B. Install motors on concrete bases complying with Division 3.

- C. Comply with mounting and anchoring requirements specified in Division 15 Section "Mechanical Vibration Controls."

3.3 FIELD-INSTALLED CAPACITOR INSTALLATION

- A. Mount capacitors shipped separately beside motor connection box as required. Connect in accordance with the requirements of Division 16, Electrical.
 - 1. Test units at full rated load after the installation of the motor capacitors, and submit reports.

3.4 FIELD QUALITY CONTROL FOR FIELD-INSTALLED MOTORS

- A. Prepare for acceptance tests.
 - 1. Align motors, bases, shafts, pulleys, and belts. Tension belts according to manufacturer's written instructions.
 - 2. Verify bearing lubrication.
 - 3. Run each motor with its controller. Demonstrate correct rotation, alignment, and speed at motor design load.
 - 4. Test interlocks and control and safety features for proper operation.
 - 5. Verify that current and voltage for each phase comply with nameplate rating and NEMA MG 1 tolerances.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.
- C. Testing Agency: Engage a qualified testing and inspecting agency to perform the following field tests and inspections and prepare test reports:
- D. Perform the following field tests and inspections and prepare test reports:
 - 1. Perform electrical tests and visual and mechanical inspections including optional tests and inspections stated in NETA ATS on factory- and field-installed motors. Certify compliance with test parameters.
 - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

3.5 FIELD-INSTALLED MOTOR DEMONSTRATION

- A. Engage a factory-authorized service representative to train Government's maintenance personnel to adjust, operate, and maintain field-installed motors. Refer to Division 01 Section "General Requirements".

END OF SECTION 15055

SECTION 15060 - HANGERS AND SUPPORTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following hangers and supports for mechanical system piping and equipment:
 - 1. Steel pipe hangers and supports.
 - 2. Trapeze pipe hangers.
 - 3. Metal framing systems.
 - 4. Thermal-hanger shield inserts.
 - 5. Fastener systems.
 - 6. Pipe stands.
 - 7. Equipment supports.
- B. Related Sections include the following:
 - 1. Division 15 Section "Basic Mechanical Materials and Methods" for general piping materials and installation requirements.
 - 2. Division 15 Section "Mechanical Vibration Controls" for vibration isolation devices.
 - 3. Division 15 Section "Pipe Insulation" for pipe insulation.
 - 4. Division 15 Section "Metal Ducts" for duct hangers and supports.

1.3 REFERENCED STANDARDS

- A. American Welding Society
 - 1. AWS D1.1: Structural Welding Code - Steel
 - 2. AWS D1.2: Structural Welding Code - Aluminum
 - 3. AWS D1.3: Structural Welding Code - Sheet Steel
 - 4. AWS D1.4: Structural Welding Code - Reinforcing Steel
- B. ASME International
 - 1. ASME B31.1: Power Piping
 - 2. ASME B31.9: Building Services Piping
- C. ASTM International
 - 1. ASTM A 36/A 36M: Specification for Carbon Structural Steel

2. ASTM A 780: Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
 3. ASTM C 533: Specification for Calcium Silicate Block and Pipe Thermal Insulation
 4. ASTM C 552: Specification for Cellular Glass Thermal Insulation
 5. ASTM C 1107: Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
- D. The International Association of Plumbing and Mechanical Officials
1. IAPMO PS 42: Pipe Alignment and Secondary Support Systems
- E. Manufacturers Standardization Society of The Valve and Fittings Industry Inc.
1. MSS SP-58: Pipe Hangers and Supports - Materials, Design and Manufacture
 2. MSS SP-69: Pipe Hangers and Supports - Selection and Application
 3. MSS SP-89: Pipe Hangers and Supports - Fabrication and Installation Practices
 4. MSS SP-90: Guidelines on Terminology for Pipe Hangers and Supports
- F. Metal Framing Manufacturers Association
1. MFMA-4: Metal Framing Standards Publication
 2. MFMA-103: Guidelines for the Use of Metal Framing
- G. SSPC: The Society for Protective Coatings
1. SSPC-PA 1: Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel

1.4 DEFINITIONS

- A. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."
1. Hot Systems: Operating (service) temperatures 120 to 450 degrees F (49 to 232 degrees C).
 2. Ambient Systems: Operating (service) temperatures 60 to 119 degrees F (16 to 48 degrees C).
 3. Cold Systems: Operating (service) temperatures 33 to 59 degrees F (1 to 59 degrees C).

1.5 PERFORMANCE REQUIREMENTS

- A. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water, plus a 50 percent safety factor.
- B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components, plus a 50 percent safety factor.

1.6 SUBMITTALS

- A. Product Data: Submit product data and applications for the following:
 - 1. Steel pipe hangers and supports.
 - 2. Thermal-hanger shield inserts.
 - 3. Each type of fastener system.
- B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following:
 - 1. Trapeze pipe hangers. Include Product Data for components.
 - 2. Metal framing systems. Include Product Data for components.
 - 3. Pipe stands. Include Product Data for components.
 - 4. Equipment supports.
 - 5. Welding certificates.

1.7 QUALITY ASSURANCE

- A. Hangers, supports, guides, and anchors shall comply with the requirements of:
 - 1. MSS SP-58.
 - 2. ASME B31.9.
- B. Installation of hangers, supports, guides, and anchors shall comply with MSS SP-69.
- C. Engineering responsibility: Design and preparation of Shop Drawings and calculations for each multiple pipe support and trapeze by a qualified professional engineer.
 - 1. Professional engineering qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of hangers and supports that are similar to those indicated for this Project in material, design, and extent.
- D. Hangers, supports, guides, and anchors shall comply with the requirements of ASME B31.1, Power Piping, including design, fabrication, and installation, when they support:
 - 1. Steam piping systems operating at 250 degrees F (120 degrees C) and higher or 15 psig (100 kPa) and higher.
- E. Qualifications of welders: As specified in Division 15 Section "Basic Mechanical Materials and Methods."

PART 2 - PRODUCTS

2.1 STEEL PIPE HANGERS AND SUPPORTS

- A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.
- B. Galvanized, Metallic Coatings: Pregalvanized or hot dipped.

2.2 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural-steel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts.

2.3 METAL FRAMING SYSTEMS

- A. Description: MFMA-4, shop- or field-fabricated pipe-support assembly made of steel channels and other components.
- B. Coatings: Manufacturer's standard finish, unless bare metal surfaces are indicated.

2.4 THERMAL-HANGER SHIELD INSERTS

- A. Description: 600-psig- (4140-kPa-) minimum, compressive-strength insulation insert encased in sheet metal shield, with insulation same thickness as piping insulation.
- B. Insulation-Insert Material for Cold Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with vapor barrier.
- C. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate.
- D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- E. For Clevis Hangers: Insert and shield shall cover entire circumference of pipe.
- F. Insert Length: Extend at least one inch (25 mm) beyond each side of the sheet metal shield for installation of vapor barrier tape.
- G. Insulation shield: Rolled shield of G90 galvanized steel of gage and length appropriate for the compressive strength of the insert and type of hanger.

2.5 FASTENER SYSTEMS

- A. Fasteners to concrete construction:
 - 1. Powder-Actuated Fasteners: Threaded-steel stud with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
 - 2. Mechanical-Expansion Anchors: Insert-wedge-type stainless steel with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used. Fasteners to ceilings shall be vibration and shock resistant. Load

applied to fasteners shall not exceed 25 percent of manufacturer's stated load capacity in 3500 psi (24,000 kPa) concrete.

3. Adhesive anchors: Stainless-steel threaded anchors with epoxy adhesive in glass container.

B. Fasteners to wood construction: Galvanized steel lag bolts.

C. Fasteners to steel construction: Structural welding or bolted assemblies per hanger or support type. Welding standards are specified in Division 15 Section "Basic Mechanical Materials and Methods."

2.6 PIPE STAND FABRICATION

A. Pipe Stands, General: Shop or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.

B. Curb-Mounting-Type Pipe Stands: Shop- or field-fabricated pipe support made from galvanized or stainless structural steel shape, continuous-thread rods, and rollers for mounting on permanent stationary roof curb.

2.7 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes. Provide galvanized or stainless steel supports for exterior or tunnel applications.

2.8 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.

2. Design Mix: 5000-psi/34.5-MPa, 28-day compressive strength.

C. Hanger Rod: MSS SP-58, solid steel, all threaded hanger rods, nuts, and washers; zinc-plated.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

A. Specific hanger and support requirements, hanger types and spacing, and hanger rod sizing are specified in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.

- C. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings or copper plating on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30 (DN 15 to DN 750).
 - 2. Adjustable Swivel-Ring Band Hangers, copper-plated, (MSS Type 10): For suspension of noninsulated copper stationary pipes, NPS 1/2 to NPS 2 (DN 15 to DN 50).
 - 3. U-Bolts (MSS Type 24): For support of heavy pipes, NPS 1/2 to NPS 30 (DN 15 to DN 750).
 - 4. Pipe Stanchion Saddles (MSS Type 37): For support of pipes, NPS 4 to NPS 36 (DN 100 to DN 900), with steel pipe base stanchion support and cast-iron floor flange and with U-bolt to retain pipe.
 - 5. Single Pipe Rolls (MSS Type 41): For suspension of pipes, NPS 1 to NPS 30 (DN 25 to DN 750), from 2 rods if longitudinal movement caused by expansion and contraction might occur.
 - 6. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes, NPS 2-1/2 to NPS 20 (DN 65 to DN 500), from single rod if horizontal movement caused by expansion and contraction might occur.
 - 7. Complete Pipe Rolls (MSS Type 44): For support of pipes, NPS 2 to NPS 42 (DN 50 to DN 1050), if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
 - 8. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes, NPS 2 to NPS 30 (DN 50 to DN 750), if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.
- F. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20 (DN 20 to DN 500).
 - 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20 (DN 20 to DN 500), if longer ends are required for riser clamps.
- G. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following type:
 - 1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches (150 mm).
- H. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
 2. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
 3. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams.
 4. C-Clamps (MSS Type 23): For structural shapes.
 5. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
 6. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:
 - a. Light (MSS Type 31): 750 lb (340 kg).
 - b. Medium (MSS Type 32): 1500 lb (680 kg).
 - c. Heavy (MSS Type 33): 3000 lb (1360 kg).
 7. Side-Beam Brackets (MSS Type 34): For sides of steel beams.
- I. Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Protection Shields (MSS Type 40): For insulated piping, NPS 1/2 to NPS 1-1/2 (DN 15 to DN 40).
 2. Thermal-Hanger Shield Inserts: For insulated piping, NPS 2 (DN 50) and larger. For piping NPS 8 (DN 200) and larger, provide 1/4-inch-thick steel wear plate, minimum 6 inches long.
- J. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.
- K. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.
- L. Use powder-actuated fasteners or adhesive anchors instead of building attachments where required in concrete construction.

3.2 HANGER AND SUPPORT INSTALLATION

- A. Steel Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.
1. Attaching to walls: Use two 0.375-inch (9.5-mm) screw-type fasteners for attaching brackets and three 0.5-inch (13-mm) bolt-type fasteners for attaching structural supports.
 2. Attaching to existing construction: Where necessary to obtain suitable strength for load on concrete slabs or planks, bolt sections of structural channels to slab or planks, using two or more expansion shields as above, and attach hanger rod to the channel.

- a. Steel joists: Provide structural channels between panel points of at least two joists.
 - b. Concrete slabs: Use expansion shields and steel bolt or rod.
 - c. Concrete, where adhesive anchors are required: Install in accordance with manufacturer's instructions.
 - d. Wood joists: Use side beam connectors.
3. Attaching to concrete slab: Secure hanger rods to malleable iron inserts properly spaced and set on the forms before concrete is poured.
4. Attaching to steel decks: Attach hanger rods to the hanger tabs on underside of deck, or pass them through the steel deck and secure on top side with nut, locknut and plate washer.
 - a. Plate washers: 4 by 8 inches by 0.125 inch thick (100 mm by 200 mm by 6 mm) for 0.375-inch and 0.5-inch (10 mm and 15 mm) rods; 6 by 12 inches by 0.187 inch (150 by 305 by 5 mm) thick for 0.625-inch (16-mm) and larger rods.
 - b. Top of hanger assembly shall be concealed in the concrete fill which will be placed over the deck.
- B. Trapeze Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated trapeze pipe hangers.
 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
 2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.
- C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.
- D. Fastener System Installation:
 1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches 100 mm thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
 2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- E. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.
- F. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

- G. Install hangers and supports to allow controlled thermal movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- H. Install lateral bracing with pipe hangers and supports to prevent swaying.
- I. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, N.S. 2-1/2 (DN 65) and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- J. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- K. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.1 (for power piping) and ASME B31.9 (for building services piping) are not exceeded.
- L. Insulated Piping: Comply with the following:
 - 1. Attach hangers and supports to piping.
 - a. Piping Systems without Vapor Barrier: Hangers or supports may project through insulation. For piping NPS 1/2 to NPS 1-1/2 (DN 15 to 40) use protection shield if hanger is sized for insulation thickness. For piping NPS 2 (DN 50) and larger, use thermal-hanger shield inserts if hanger is sized for insulation thickness.
 - b. Piping systems with Vapor Barrier: Insulation shall be continuous through hanger. For piping NPS 1/2 to NPS 1-1/2 (DN 15 to DN 40) use protection shield. For piping NPS 2 (DN 50) and larger use thermal-hanger shield inserts.
 - c. Do not exceed pipe stress limits according to ASME B31.1 for power piping and ASME B31.9 for building services piping.
 - 2. Install MSS SP-58, Type 40, protective shields on piping where indicated above. Shields shall span an arc of 180 degrees. Shield dimensions shall not be less than 12 inches (305 mm) long and 0.048 inch (1.22 mm) thick. Size hanger or support to match outside diameter of shield.
 - 3. Install thermal hanger shield inserts where indicated above. Include weight-distribution plate for pipe NPS 4 (DN 100) and larger pipe is installed on rollers. Size hanger or support to match outside diameter of insert.

3.3 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

- B. Grouting: Place grout under supports for equipment and make smooth bearing surface.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.4 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Welding standards are specified in Division 15 Section “Basic Mechanical Materials and Methods”.

3.5 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches (40 mm) maximum.

3.6 PAINTING

- A. Touch Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 - 1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils (0.05 mm.)
- B. Touch Up: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 9 painting Sections.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 15060

SECTION 15071 - MECHANICAL VIBRATION CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Elastomeric isolation mounts.
 - 2. Restrained spring isolators.
 - 3. Spring hangers.
 - 4. Spring hangers with vertical-limit stops.
- B. Related Sections:
 - 1. Division 3 Section "Cast-in-Place Concrete" for cast-in-place concrete, reinforcement, and formwork for equipment bases.
 - 2. Division 15 Section "Basic Mechanical Materials and Methods" for general construction materials and methods for mechanical installations.
 - 3. Division 15 Section "Hangers and Supports" for general requirements for pipe hangers, guides, anchors, and supports.

1.3 REFERENCED STANDARDS

- A. American Association of State Highway and Transportation Officials
- B. AASHTO M 251: Plain and Laminated Elastomeric Bridge Bearings
- C. American Society for Testing and Materials
- D. ASTM A 36/A 36M: Specification for Carbon Structural Steel
- E. ASTM E 488: Test Methods for Strength of Anchors in Concrete and Masonry Elements
- F. American Welding Society
- G. AWS D1.1: Structural Welding Code-Steel

1.4 SUBMITTALS

- A. Product Data: Include load deflection curves for each vibration isolation device.
- B. Shop Drawings: Signed and sealed by a qualified professional engineer. Include the following:

1. Design Calculations: Calculate requirements for selecting vibration isolators for designing vibration isolation bases.
 2. Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, and spring deflection changes. Include certification that riser system has been examined for excessive stress and that none will exist.
 3. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, base weights, equipment static loads, power transmission, component misalignment, and cantilever loads.
- C. Welding certificates.
- D. Air-Mounting System Performance Certification: Include natural frequency, load, and damping tests performed by an independent laboratory or acoustician.

1.5 QUALITY ASSURANCE

- A. Welding: Refer to Division 15 Section "Basic Mechanical Materials and Methods" for welding requirements.

1.6 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into base. Concrete, reinforcement, and formwork requirements are specified in Division 3.

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATORS

- A. Elastomeric Mounts: Double-deflection type, with molded, oil-resistant rubber or neoprene isolator elements with factory-drilled, encapsulated top plate for bolting to equipment and with baseplate for bolting to structure. Color-code or otherwise identify to indicate capacity range.
1. Durometer Rating: 45.
- B. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with restraint.
1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to wind loads or if weight is removed; factory-drilled baseplate bonded to 1/4-inch- (6-mm-) thick, elastomeric isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation.
 2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 4. Lateral Stiffness: More than 80 percent of the rated vertical stiffness.
 5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

- C. Spring Hangers: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression.
1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
 2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 4. Lateral Stiffness: More than 80 percent of the rated vertical stiffness.
 5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
 6. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
- D. Spring Hangers with Vertical-Limit Stop: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression and with a vertical-limit stop.
1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
 2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 4. Lateral Stiffness: More than 80 percent of the rated vertical stiffness.
 5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
 6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
 7. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.

2.2 FACTORY FINISHES

- A. Finish: Manufacturer's standard paint applied to factory-assembled and -tested equipment before shipping.
1. Powder coating on springs and housings.
 2. All hardware shall be electrogalvanized. Hot-dip galvanize metal components for exterior use.
 3. Baked enamel for metal components on isolators for interior use.
 4. Color-code or otherwise mark vibration isolation devices to indicate capacity range.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and equipment to receive vibration isolation devices for compliance with requirements, installation tolerances, and other conditions affecting performance.

- B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 EQUIPMENT BASES

- A. Concrete Bases: Anchor equipment to concrete base according to supported equipment manufacturer's written instructions.
 - 1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of the base.
 - 2. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base and anchor into structural concrete floor.
 - 3. Place and secure anchorage devices. Use Setting Drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 4. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - 5. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
 - 6. Cast-in-place concrete materials and placement requirements are specified in Division 3.

3.3 FIELD QUALITY CONTROL

- A. Testing: Engage a qualified testing agency or personnel to perform the following field quality-control testing:
 - 1. Isolator deflection within range of supplied device.
 - 3. Verification of deflection range without short-circuiting.

3.4 ADJUSTING

- A. Adjust isolators after piping systems have been filled and equipment is at operating weight.
- B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.
- C. Adjust active height of spring isolators.

3.5 CLEANING

- A. After completing equipment installation, inspect vibration isolation devices. Remove paint splatters and other spots, dirt, and debris.

3.5 VIBRATION ISOLATOR SCHEDULE

(See next page)

Equipment Type Description	Equipment Location					
	Slab On Grade			Suspended From Structure		
	Base Type	Isolator Type	Minimum Deflection	Base Type	Isolator Type	Minimum Deflection
Fans - Centrifugal, Axial, In-Line						
• Up to 300 rpm	B	1	0.35-inch (9 mm)	-	3	1.0 inch (25 mm)
• 300-500 rpm	B	1	0.35-inch (9 mm)	-	3	1.0 inch (25 mm)
• 501 and above	B	1	0.35-inch (9 mm)	-	3	1.0 inch (25 mm)
Fan coil units	A	1	0.35-inch (9 mm)	-	3	1.0 inch (25 mm)
Diesel-Engine Generators	A	2	2.50-inch (65 mm)	-	-	-
• Suspended-connected to equipment						
- NPS 3 pipe and smaller	-	-	-	4	9	0.75 inch (20 mm)
- NPS 4 through 6 pipe	-	-	-	4	9	1.5 inch (40 mm)
- NPS 8 and larger pipe (diesel-engine exhaust piping and muffler)	-	-	-	4	9	2.5 inch (65 mm)

Notes

Base Types:

- A. No base, isolators attached directly to equipment.
- B. Structural steel rails or base.

Isolator Types:

- 1. Elastomeric mounts
- 2. Restrained spring isolators
- 3. Spring hangers
- 4. Spring hangers with vertical limit stops

END OF SECTION 15071

SECTION 15075 - MECHANICAL IDENTIFICATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following mechanical identification materials and their installation:
 - 1. Equipment nameplates.
 - 2. Equipment markers.
 - 3. Equipment signs.
 - 4. Access panel and door markers.
 - 5. Pipe markers.
 - 6. Duct markers.
 - 7. Stencils.
 - 8. Valve tags.
 - 9. Valve schedules.
 - 10. Warning tags.
- B. Related sections:
 - 1. Division 9 Section "Painting" for field-applied finishes for mechanical equipment and systems.
 - 2. Division 13 fire-suppression Sections for specific sign requirements.
 - 3. Division 15 Section "Pipe Insulation" for piping and specialty insulation.

1.3 REFERENCED STANDARDS

- A. American Society for Testing and Materials:
 - 1. ASTM C 1036: Specification for Flat Glass.
 - 2. ASTM D 709: Specification for Laminated Thermosetting Materials.
- B. American Society of Mechanical Engineers
 - 1. ASME A13.1: Scheme for the Identification of Piping Systems.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.

- B. Samples: For color, letter style, and graphic representation required for each identification material and device.
- C. Equipment and valve numbering scheme lists, prior to identification installation.
- D. Valve Schedules: For each piping system. Furnish extra copies (in addition to mounted copies) to include in maintenance manuals.

1.5 QUALITY ASSURANCE

- A. ASME Compliance: Comply with ASME A13.1, "Scheme for the Identification of Piping Systems," for letter size, length of color field, colors (except as modified herein), and viewing angles of identification devices for piping.

1.6 COORDINATION

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with location of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT IDENTIFICATION DEVICES

- A. Equipment Identification. Refer to stencils for equipment identification.
- B. Access Panel and Door Markers: 1/16-inch- (1.6-mm-) thick, engraved laminated plastic, with abbreviated terms and numbers corresponding to identification. Provide 1/8-inch (3.2-mm) center hole for attachment.
 - 1. Fasteners: Self-tapping, stainless-steel screws or contact-type, permanent adhesive.

2.2 PIPING IDENTIFICATION DEVICES

- A. Piping Identification: Refer to stencils for piping identification.

2.3 DUCT IDENTIFICATION DEVICES

- A. Duct Identification: Refer to stencils for duct identification.

2.4 STENCILS

- A. Stencils, General: Manufactured stencils prepared for required applications.
 - 1. Stencil Material: Metal or fiberboard.

2. Stencil Paint: Exterior, gloss, enamel black, unless otherwise indicated. Paint may be in pressurized spray-can form.
 3. Identification Paint: Exterior, enamel in colors according to ASME A13.1, unless otherwise indicated.
- B. Piping: Prepared with letter sizes according to ASME A13.1. Indicate piping system service, and direction of flow. Provide colors in accordance with the Piping and Ductwork Identification schedule at the end of this Section. Paint complete piping system where indicated.
- C. Ductwork: Prepared with minimum letter height of 2 inches (50 mm). Indicate air-handling unit number, duct system service, and direction of flow. Provide colors in accordance with the Identification Schedule.
- D. Equipment: Prepared with minimum letter height of 2 inches (50 mm). Indicate building name abbreviation, equipment type abbreviation, and equipment number. Government shall approve equipment numbering prior to installation.

2.5 VALVE TAGS

- A. Valve Tags: Stamped or engraved with minimum 1/4-inch (6.4-mm) letters for building name abbreviation, piping system abbreviation, and numbers, with numbering scheme approved by the Government. Provide 5/32-inch (4-mm) hole for fastener.
1. Material: 0.032-inch- (0.8-mm-) thick brass.
 2. Size and Shape: 2.0 inches (50 mm) round.
 3. Letter Color: Black
 4. Valve-Tag Fasteners: Brass wire-link chain.

2.6 VALVE SCHEDULES

- A. Valve Schedules: For each piping system, on standard-size bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), building name, normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses. Government shall approve valve numbering prior to installation.
1. Valve-Schedule Frames: Glazed display frame for removable mounting on masonry walls for each page of valve schedule. Include mounting screws.
 2. Frame: Finished hardwood or Extruded aluminum.
 3. Glazing: ASTM C 1036, Type I, Class 1, Glazing Quality B, 2.5-mm, single-thickness glass.

2.7 WARNING TAGS

- A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags; of plasticized card stock with matte finish suitable for writing.

1. Size: 3 by 5-1/4 inches (75 by 133 mm) minimum.
2. Fasteners: Brass grommet and wire.
3. Nomenclature: Large-size primary caption such as DANGER, CAUTION, or DO NOT OPERATE.
4. Color: Yellow background with black lettering.

PART 3 - EXECUTION

3.1 APPLICATIONS, GENERAL

- A. Products specified are for applications referenced in other Division 15 Sections. If more than single-type material, device, or label is specified for listed applications, selection is Installer's option.

3.2 EQUIPMENT IDENTIFICATION

- A. Install equipment stenciled markers on each major item of mechanical equipment.
 1. Letter Size: Minimum 2 inches (50 mm) for name of units for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
 2. Data: Distinguish among multiple units, indicate operational requirements, indicate safety and emergency precautions, warn of hazards and improper operations, and identify units.
 3. Locate markers where accessible and visible. Include markers for the following general categories of equipment:
 - a. Fans and primary balancing dampers.
 - b. Packaged HVAC zone-type units.
 4. Paint belt guards on equipment. Color shall be safety orange.
- B. Install access panel markers with screws on equipment access panels.

3.3 PIPING IDENTIFICATION

- A. Install stenciled pipe markers with painted, color-coded bands or rectangles complying with ASME A13.1 and colors in the Identification Schedule on each piping system.
 1. Identification Paint: Use for contrasting background.
 2. Stencil Paint: Use for pipe marking.
- B. Locate pipe stenciled markers where piping is exposed in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior nonconcealed locations as follows:
 1. Near each valve and control device.

2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and nonaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet (15 m) along each run. Reduce intervals to 25 feet (7.6 m) in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced markers.

3.4 DUCT IDENTIFICATION

- A. Install duct stenciled markers on air ducts complying with the Identification Schedule:
- B. Locate markers near points where ducts enter into concealed spaces and at maximum intervals of 50 feet (15 m) in each space where ducts are exposed or concealed by removable ceiling system.

3.5 VALVE-TAG INSTALLATION

- A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; plumbing fixture supply stops; shutoff valves; faucets; convenience and lawn-watering hose connections; and HVAC terminal devices, unitary equipment and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

3.6 VALVE-SCHEDULE INSTALLATION

- A. Mount valve schedule on wall in accessible location in each major equipment room or where directed by the Government.

3.7 WARNING-TAG INSTALLATION

- A. Write required message on, and attach warning tags to, equipment and other items where required.

3.8 ADJUSTING

- A. Relocate mechanical identification materials and devices that have become visually blocked by other work.

3.9 CLEANING

- A. Clean faces of mechanical identification devices.

3.10 SCHEDULES

Piping and Ductwork Identification			
Piping/Duct System Service	Paint Color	Mechanical and Utility Spaces	Exposed in Public Spaces
Fuel oil for generators	Yellow	Paint and Stencil	Black letter stencil only
Fire suppression	Red	Paint and Stencil	Paint and stencil
Domestic cold water	Not painted	Paint and Stencil	Off-white paint and black letter stencil only
Domestic hot water	Not painted	Paint and Stencil	Off-white paint and black letter stencil only
Supply air ductwork	Not painted	Paint and Stencil	Off-white paint and black letter stencil only
Return air ductwork	Not painted	Paint and Stencil	Off-white paint and black letter stencil only
Exhaust air ductwork	Not painted	Paint and Stencil	Off-white paint and black letter stencil only

END OF SECTION 15075

SECTION 15081 - DUCT INSULATION

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes semirigid duct insulation; accessories and attachments; and sealing compounds.
- B. Related Sections include the following:
 - 1. Division 7 Section "Firestopping" for firestopping materials and requirements for penetrations through fire and smoke barriers.
 - 2. Division 15 Section "Pipe Insulation" for insulation for piping systems.

1.2 REFERENCED STANDARDS

- A. American Society for Testing and Materials
 - 1. ASTM A 666: Specification for Austenitic Stainless Sheet, Strip, Plate, and Flat Bar
 - 2. ASTM C 195: Specification for Mineral Fiber Thermal Insulating Cement
 - 3. ASTM C 196: Specification for Expanded or Exfoliated Vermiculite Thermal Insulating Cement
 - 4. ASTM C 449/C 449M: Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement
 - 5. ASTM C 533: Specification for Calcium Silicate Block and Pipe Thermal Insulation
 - 6. ASTM C 534: Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form
 - 7. ASTM C 553: Specification for Mineral Fiber Blanket and Felt Insulation for Commercial and Industrial Applications
 - 8. ASTM C 612: Specification for Mineral Fiber Block and Board Thermal Insulation
 - 9. ASTM C 921: Practice for Determining the Properties of Jacketing Materials for Thermal Insulation
 - 10. ASTM C 1126: Specification for Faced or Unfaced and Cellular Phenolic Thermal Insulation
 - 11. ASTM E 84: Test Method for Surface Burning Characteristics of Building Materials.
- B. Military Specification
 - 1. MIL-C-20079H: Cloth, Glass; Tape, Textile Glass and Thread, Glass and Wire-Reinforced Glass

1.3 DEFINITIONS

- A. Ceiling space: The space between the ceiling and the floor of an air-conditioned space above.

- B. Roof space: The space between the ceiling and the roof, where building insulation is located at the roof level, or the space between the ceiling and the floor of a non-air conditioned space above.
- C. Attic space: The space between the ceiling and the roof, where building insulation is located at the ceiling level.
- D. Air-conditioned areas or spaces: Areas or spaces where the occupied room temperature is maintained between 65 and 80 degrees F (18.3 and 26.7 degrees C).
- E. Ambient temperature: 70 degrees F (23 degrees C). Cooling systems operate below ambient temperature. Heating only systems operate at or above ambient temperature.
- F. Concealed insulation shall include work:
 - 1. Above ceilings.
 - 2. Where furred in and in pipe chases.
- G. Exposed insulation shall include work:
 - 1. In all rooms and areas.
 - 2. In mechanical and electrical equipment rooms, penthouses, or spaces.
 - 3. In storage rooms.

1.4 SUBMITTALS

- A. Product Data: Identify thermal conductivity, density, permeance, operating temperature range, flame-spread rating, vapor barrier, and jackets (both factory and field applied, if any), for each type of product indicated.
- B. Schedule: Schedule of locations for use, insulation type, thickness, vapor barrier, and jacket used.
- C. Installer Certificates: Signed by the Contractor certifying that installers comply with qualification requirements.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the U.S. Department of Labor, Bureau of Apprenticeship and Training.
- B. Fire-Test-Response Characteristics: As determined by testing materials identical to those specified in this Section according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and sealer and cement material containers with appropriate markings of applicable testing and inspecting agency.

1. Insulation Installed Indoors: Flame-spread rating of 25 or less, and smoke-developed rating of 50 or less.

C. Asbestos-Free: All insulation and accessories shall be asbestos-free.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Ship insulation materials in containers marked by manufacturer with appropriate ASTM specification designation, type and grade, and maximum use temperature.

1.7 COORDINATION

- A. Coordinate clearance requirements with duct Installer for insulation application.

1.8 SCHEDULING

- A. Schedule insulation application after testing duct systems. Insulation application may begin on segments of ducts that have satisfactory test results.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

- A. Mineral-Fiber Board Thermal Insulation: Glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IB, K-factor of 0.22 at 75 degrees F mean temperature, density 6 lbs per cubic foot, without facing and with all-service jacket manufactured from kraft paper, reinforcing scrim, aluminum foil, and vinyl film.

2.2 ACCESSORIES AND ATTACHMENTS

- A. Glass Cloth and Tape: Comply with MIL-C-20079H, Type I for cloth and Type II for tape. Woven glass-fiber fabrics, plain weave, presized a minimum of 8 oz./sq.yd.(270 g/sq.m).
1. Tape width: 4 inches (100 mm).
- B. Bands: 3/4 inch (19 mm) wide, in one of the following materials compatible with jacket:
1. Stainless Steel: ASTM A 666, Type 304; 0.020 inch (0.5 mm) thick.
 2. Galvanized Steel: 0.005 inch (0.13 mm) thick.
- C. Adhesive-Attached Anchor Pins and Speed Washers: Galvanized steel plate, pin, and washer manufactured for attachment to duct and plenum with adhesive. Pin length sufficient for insulation thickness indicated.
1. Adhesive: Recommended by the anchor pin manufacturer as appropriate for surface temperatures of ducts, plenums, and breechings; and to achieve a holding capacity of 100 lb (45 kg) for direct pull perpendicular to the adhered surface.

2.3 VAPOR RETARDERS

- A. Mastics: Materials recommended by insulation material manufacturer that are compatible with insulation materials, jackets, and substrates.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.3 GENERAL APPLICATION REQUIREMENTS

- A. Apply insulation materials, accessories, and finishes according to the manufacturer's written instructions; with smooth, straight, and even surfaces; and free of voids throughout the length of ducts and fittings.
- B. Refer to schedules at the end of this Section for materials, forms, jackets, and thicknesses required for each duct system.
- C. Use accessories compatible with insulation materials and suitable for the service. Use accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Apply multiple layers of insulation with longitudinal and end seams staggered.
- E. Seal joints and seams with vapor-retarder mastic on insulation indicated to receive a vapor retarder.
- F. Keep insulation materials dry during application and finishing.
- G. Apply insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by the insulation material manufacturer.
- H. Apply insulation with the least number of joints practical.
- I. Apply insulation over fittings and specialties, with continuous thermal and vapor-retarder integrity, unless otherwise indicated.

- J. Hangers and Anchors: Where vapor retarder is indicated, seal penetrations in insulation at hangers, supports, anchors, and other projections with vapor-retarder mastic. Apply insulation continuously through hangers and around anchor attachments.
- K. Insulation Terminations: For insulation application where vapor retarders are indicated, seal ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.
- L. Apply insulation with factory-applied jackets as follows:
 - 1. Pull factory-applied jacket tight and smooth.
 - 2. Joints and Seams: Cover with tape and vapor retarder as recommended by insulation material manufacturer to maintain vapor seal.
 - 3. Vapor-Retarder Mastics: Where vapor retarders are indicated, apply mastic on seams and joints and at ends adjacent to duct flanges and fittings.
- M. Cut insulation according to manufacturer's written instructions to prevent compressing insulation to less than 75 percent of its nominal thickness.
- N. Install vapor-retarder mastic on ducts and plenums scheduled to receive vapor retarders.
 - 1. Ducts with Vapor Retarders: Overlap insulation facing at seams and seal with vapor-retarder mastic and pressure-sensitive tape having same facing as insulation. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-retarder seal.
 - 2. Ducts without Vapor Retarders: Overlap insulation facing at seams and secure with outward clinching staples and pressure-sensitive tape having same facing as insulation.
- O. Interior Wall and Partition Penetrations: Apply insulation continuously through walls and partitions, except fire-rated walls and partitions.
- P. Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire/smoke damper sleeves for fire-rated wall and partition penetrations.

3.4 MINERAL-FIBER INSULATION APPLICATION

- A. Board Applications for Ducts: Secure board insulation with adhesive and anchor pins and speed washers.
 - 1. Apply adhesives according to manufacturer's recommended coverage rates per square foot, for 100 percent coverage of duct and plenum surfaces.
 - 2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
 - 3. Space anchor pins as follows:

- a. On duct sides with dimensions 18 inches (450 mm) and smaller, along longitudinal centerline of duct. Space 3 inches (75 mm) maximum from insulation end joints, and 16 inches (400 mm) o.c.
 - b. On duct sides with dimensions larger than 18 inches (450 mm). Space 16 inches (400 mm) o.c. each way, and 3 inches (75 mm) maximum from insulation joints. Apply additional pins and clips to hold insulation tightly against surface at cross bracing.
 - c. Anchor pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
 - d. Do not overcompress insulation during installation.
- B. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
- C. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches (50 mm) from one edge and one end of insulation segment. Secure laps to adjacent insulation segment with 1/2-inch (13-mm) staples, 1 inch (25 mm) o.c., and cover with pressure-sensitive tape having same facing as insulation.
- D. Apply insulation on rectangular duct elbows and transitions with a full insulation segment for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Apply insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
- E. Insulate duct stiffeners, hangers, and flanges that protrude beyond the insulation surface with 6-inch- (150-mm-) wide strips of the same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with anchor pins spaced 6 inches (150 mm) o.c.
- F. Apply vapor-retarder mastic to open joints, breaks, and punctures for insulation indicated to receive vapor retarder.

3.5 DUCT SYSTEM APPLICATIONS

- A. Insulation materials and thicknesses are specified in schedules at the end of this Section.
- B. Materials and thicknesses for systems listed below are specified in schedules at the end of this Section.
- C. Insulate the following plenums and duct systems:
1. Indoor concealed supply-, return-, outdoor- exhaust-, transfer-, and pressure relief-air ductwork.
 2. Indoor exposed supply-, return-, outdoor-exhaust-, transfer-, and pressure relief-air ductwork.
- D. Items Not Insulated: Unless otherwise indicated, do not apply insulation to the following systems, materials, and equipment:

1. Metal ducts with duct liner.
2. Factory-insulated flexible ducts.
3. Factory-insulated plenums, casings, terminal boxes, and filter boxes and sections.
4. Flexible connectors.
5. Vibration-control devices.
6. Testing agency labels and stamps.
7. Nameplates and data plates.
8. Access panels and doors in air-distribution systems.

3.6 INDOOR DUCT AND PLENUM APPLICATION SCHEDULE

Indoor Duct and Plenum Application Schedule						
Service	Material	Thickness	Vapor Retarder Required	Field Applied Jacket	Locations Required	Exceptions
Supply-air ducts, exposed	Mineral-fiber board with factory applied jacket	2 inches (50 mm)	Note A	Canvas cloth		Note 4
Return-air and transfer-air ducts, exposed	Mineral-fiber board with factory applied jacket	2 inches (50 mm)	Note A	Canvas cloth		Note 4
Exhaust-air and pressure relief-air ducts, exposed.	Mineral-fiber board with factory applied jacket	2 inches (50 mm)	Note A	Canvas cloth	Note 2	

Note A - Provide vapor barrier for duct systems operating below ambient temperature of 70 F.

Note 2- a. Insulate from duct connection at exterior opening to ATC or backdraft damper.

b. Insulate duct from air-conditioned areas located in attic or roof space.

Note 4- Ducts exposed in areas they serve shall not be insulated.

END OF SECTION 15081

SECTION 15083 - PIPE INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes preformed, rigid and flexible pipe insulation; insulating cements; field-applied jackets; accessories and attachments; and sealing compounds.
- B. Related Sections include the following:
 - 1. Division 7 Section "Firestopping" for firestopping materials and requirements for penetrations through fire and smoke barriers.
 - 2. Division 15 Section "Duct Insulation" for insulation for ducts and plenums.
 - 3. Division 15 Section "Hangers and Supports" for pipe insulation shields and protection saddles.

1.3 REFERENCED STANDARDS

- A. American Society for Testing and Materials
 - 1. ASTM A 666: Specification for Austenitic Stainless Sheet, Strip, Plate, and Flat Bar
 - 2. ASTM B 209: Specification for Aluminum and Aluminum-Alloy Sheet and Plate
 - 3. ASTM B 209M: Specification for Aluminum and Aluminum-Alloy Sheet and Plate [Metric]
 - 4. ASTM C 195: Specification for Mineral Fiber Thermal Insulating Cement
 - 5. ASTM C 196: Specification for Expanded or Exfoliated Vermiculite Thermal Insulating Cement
 - 6. ASTM C 449/C 449M: Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement
 - 7. ASTM C 533: Specification for Calcium Silicate Block and Pipe Thermal Insulation
 - 8. ASTM C 534: Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form
 - 9. ASTM C 547: Specification for Mineral Fiber Preformed Pipe Insulation
 - 10. ASTM C 552: Specification for Cellular Glass Block and Pipe Thermal Insulation
 - 11. ASTM C 553: Specification for Mineral Fiber Blanket and Felt Insulation for Commercial and Industrial Applications
 - 12. ASTM C 612: Specification for Mineral Fiber Block and Board Thermal Insulation
 - 13. ASTM C 921: Practice for Determining the Properties of Jacketing Materials for Thermal Insulation
 - 14. ASTM E 84: Test Method for Surface Burning Characteristics of Building Materials
- B. Military Specifications:

1. MIL-A-3316C: Adhesives, Fire-Resistant, Thermal Insulation
2. MIL-C-19565C: Coating Compounds, Thermal Insulation, Fire- and Water-Resistant, Vapor Barrier
3. MIL-C-20079H: Cloth, Glass; Tape, Textile Glass and Thread, Glass and Wire-Reinforced Glass

1.4 DEFINITIONS

- A. Ceiling space: The space between the ceiling and the floor of an air-conditioned space above.
- B. Air-conditioned areas or spaces: Areas or spaces where the occupied room temperature is maintained between 65 and 80 degrees F (18.3 and 26.7 degrees C).
- C. Concealed insulation shall include work:
 1. Above ceilings.
 2. Where furred in and in pipe chases.
- D. Exposed insulation shall include work:
 1. In all rooms and areas.
 2. In mechanical and electrical equipment rooms, penthouses, or spaces.
 3. In storage rooms.

1.5 SUBMITTALS

- A. Product Data: Identify thermal conductivity, density, permeance, operating temperature range, flame-spread rating, vapor barrier and jackets (both factory and field applied, if any), for each type of product indicated.
- B. Shop Drawings: Show fabrication and installation details for the following:
 1. Schedule: Schedule of locations for use, insulation type, vapor barrier and jacket used.
 2. Application of protective shields and inserts at pipe hangers for each type of insulation and hanger.
 3. Attachment and covering of heat trace inside insulation.
 4. Insulation application at pipe expansion joints for each type of insulation.
 5. Insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
 6. Removable insulation at piping specialties and equipment connections.
 7. Application of field-applied jackets.
- C. Installer Certificates: Signed by the Contractor certifying that installers comply with qualification requirements.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the U.S. Department of Labor, Bureau of Apprenticeship and Training.
- B. Fire-Test-Response Characteristics: As determined by testing materials identical to those specified in this Section according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and sealer and cement material containers with appropriate markings of applicable testing and inspecting agency.
 - 1. Insulation Installed Indoors: Flame-spread rating of 25 or less, and smoke-developed rating of 50 or less.
 - 2. Insulation Installed Outdoors: Flame-spread rating of 75 or less, and smoke-developed rating of 150 or less.
- C. Asbestos-Free: All insulation and accessories shall be asbestos-free.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Ship insulation materials in containers marked by manufacturer with appropriate ASTM specification designation, type and grade, and maximum use temperature.

1.8 COORDINATION

- A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 15 Section "Hangers and Supports."
- B. Coordinate clearance requirements with piping Installer for insulation application.

1.9 SCHEDULING

- A. Schedule insulation application after testing piping systems. Insulation application may begin on segments of piping that have satisfactory test results.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

- A. Mineral-Fiber Insulation: Glass fibers bonded with a thermosetting resin complying with the following:
 - 1. Preformed Pipe Insulation: Comply with ASTM C 547, Type I, with factory-applied, all-purpose, vapor-retarder jacket.
 - a. Factory-applied all-purpose, vapor-retarder jacket: ASTM C 921, Type I, laminated, glass-fiber reinforced, flame-retardant kraft paper and aluminum foil.

2. Fire-Resistant Adhesive: Comply with MIL-A-3316C in the following classes and grades:
 - a. Class 1, Grade A for bonding glass cloth and tape to unfaced glass-fiber insulation, for sealing edges of glass-fiber insulation, and for bonding lagging cloth to unfaced glass-fiber insulation.
 - b. Class 2, Grade A for bonding glass-fiber insulation to metal surfaces.
 3. Vapor-Retarder Mastics: Fire- and water-resistant, vapor-retarder mastic for indoor applications. Comply with MIL-C-19565C, Type II.
 4. Mineral-Fiber Insulating Cements: Comply with ASTM C 195.
 5. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449/C 449M.
- B. Calcium Silicate Insulation: Preformed pipe sections of noncombustible, inorganic, hydrous calcium silicate with a non-asbestos fibrous reinforcement. Comply with ASTM C 533, Type I.
- E. Prefabricated Thermal Insulating Fitting Covers: Comply with ASTM C 450 for dimensions used in preforming insulation to cover valves, elbows, tees, and flanges.

2.2 FIELD-APPLIED JACKETS

- A. General: ASTM C 921, Type I, unless otherwise indicated.
- B. Foil and Paper Jacket: Laminated, glass-fiber-reinforced, flame-retardant kraft paper and aluminum foil.
- C. Standard PVC Fitting Covers: Factory-fabricated fitting covers manufactured from 20-mil- (0.5-mm-) thick, high-impact, ultraviolet-resistant PVC.
1. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories for the disabled.
 2. Adhesive: As recommended by insulation material manufacturer.
- D. Canvas Jacket: Eight ounces/sq.yd. (270g/sq.m), fire-retardant treated. Provide washable, abrasion-resistant finish coating.

2.3 ACCESSORIES AND ATTACHMENTS

- A. Bands: 3/4 inch (19 mm) wide, in one of the following materials compatible with jacket:
1. Stainless Steel: ASTM A 666, Type 304; 0.020 inch (0.5 mm) thick.
 2. Aluminum: 0.007 inch (0.18 mm) thick.
- B. Wire: 0.080-inch (2.0-mm), nickel-copper alloy; or 0.062-inch (1.6-mm), soft-annealed, stainless steel.

2.4 VAPOR RETARDERS

- A. Mastics: Materials recommended by insulation material manufacturer that are compatible with insulation materials, jackets, and substrates.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Preparation: Clean and dry pipe and fitting surfaces. Remove materials that will adversely affect insulation application.

3.3 GENERAL APPLICATION REQUIREMENTS

- A. Apply insulation materials, accessories, and finishes according to the manufacturer's written instructions; with smooth, straight, and even surfaces; free of voids throughout the length of piping, including fittings, valves, and specialties.
- B. Refer to schedules at the end of this Section for materials, forms, jackets, and thicknesses required for each piping system.
- C. Use accessories compatible with insulation materials and suitable for the service. Use accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Apply insulation with longitudinal seams at top and bottom of horizontal pipe runs.
- E. Apply multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Seal joints and seams with vapor-retarder mastic on insulation indicated to receive a vapor retarder.
- H. Keep insulation materials dry during application and finishing.
- I. Apply insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by the insulation material manufacturer.
- J. Apply insulation with the least number of joints practical.

- K. Apply insulation over fittings, valves, and specialties, with continuous thermal and vapor-retarder integrity, unless otherwise indicated. Refer to special instructions for applying insulation over fittings, valves, and specialties.
- L. Hangers and Anchors: Where vapor retarder is indicated, seal penetrations in insulation at hangers, supports, anchors, and other projections with vapor-retarder mastic.
1. Apply insulation continuously through hangers and around anchor attachments where vapor retarder is indicated.
 2. For insulation application where vapor retarders are indicated, extend insulation on anchor legs at least 12 inches (300 mm) from point of attachment to pipe and taper insulation ends. Seal tapered ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.
 3. Install insert materials and apply insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by the insulation material manufacturer.
 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect the jacket from tear or puncture by the hanger, support, and shield.
- M. Insulation Terminations: For insulation application where vapor retarders are indicated, taper insulation ends. Seal tapered ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.
- N. Apply adhesives and mastics at the manufacturer's recommended coverage rate.
- O. Apply insulation with integral jackets as follows:
1. Pull jacket tight and smooth.
 2. Circumferential Joints: Cover with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip and spaced 4 inches (100 mm) o.c.
 3. Longitudinal Seams: Overlap jacket seams at least 1-1/2 inches (40 mm). Apply insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches (100 mm) o.c.
 - a. Exception: Do not staple longitudinal laps on insulation having a vapor retarder.
 4. Vapor-Retarder Mastics: Where vapor retarders are indicated, apply mastic on seams and joints and at ends adjacent to flanges, unions, valves, and fittings.
 5. At penetrations in jackets for thermometers and pressure gages, fill and seal voids with vapor-retarder mastic.
- P. Interior Wall and Partition Penetrations: Apply insulation continuously through walls and partitions.

- Q. Fire-Rated Floor, Wall and Partition Penetrations: Apply insulation continuously through penetrations of fire-rated floor, walls and partitions.
1. Firestopping and fire-resistive joint sealers are specified in Division 7 Section "Firestopping."

3.4 MINERAL-FIBER INSULATION APPLICATION

- A. Apply insulation to straight pipes and tubes as follows:
1. Secure each layer of preformed pipe insulation to pipe with wire, tape, or bands without deforming insulation materials.
 2. Where vapor retarders are indicated, seal longitudinal seams and end joints with vapor-retarder mastic. Apply vapor retarder to ends of insulation at intervals of 15 to 20 feet (4.5 to 6 m) to form a vapor retarder between pipe insulation segments.
 3. For insulation with factory-applied jackets, secure laps with outward clinched staples at 6 inches (150 mm) o.c.
 4. For insulation with factory-applied jackets with vapor retarders, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by the insulation material manufacturer and seal with vapor-retarder mastic.
- B. Apply insulation to flanges as follows:
1. Apply preformed pipe insulation to outer diameter of pipe flange.
 2. Make width of insulation segment the same as overall width of the flange and bolts, plus twice the thickness of the pipe insulation.
 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
 4. Apply canvas jacket material with manufacturer's recommended adhesive, overlapping seams at least 1 inch (25 mm), and seal joints with vapor-retarder mastic.
- C. Apply insulation to fittings and elbows as follows:
1. Apply premolded insulation sections of the same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
 2. When premolded insulation elbows and fittings are not available, apply mitered sections of pipe insulation, or glass-fiber blanket insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire, tape, or bands.
 3. Cover fittings with standard PVC fitting covers.
- D. Apply insulation to valves and specialties as follows:
1. Apply premolded insulation sections of the same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.

2. When premolded insulation sections are not available, apply glass-fiber blanket insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation. For check valves, arrange insulation for access to stainer basket without disturbing insulation.
3. Apply insulation to flanges as specified for flange insulation application.
4. Use preformed standard PVC fitting covers for valve sizes where available. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.
5. For larger sizes where PVC fitting covers are not available, seal insulation with canvas jacket and sealing compound recommended by the insulation material manufacturer.

3.7 CALCIUM SILICATE INSULATION APPLICATION

A. Apply insulation to straight pipes and tubes as follows:

1. Secure each layer of insulation to pipe with stainless-steel bands at 12-inch (300-mm) intervals and tighten without deforming insulation materials.
2. Apply two-layer insulation with joints tightly butted and staggered at least 3 inches (75 mm). Secure inner layer with 0.062-inch (1.6-mm), soft-annealed, stainless-steel wire spaced at 12-inch (300-mm) intervals. Secure outer layer with stainless-steel bands at 12-inch (300-mm) intervals.
3. Apply a skim coat of mineral-fiber, hydraulic-setting cement to surface of installed insulation. When dry, apply flood coat of lagging adhesive and press on one layer of glass cloth or tape. Overlap edges at least 1 inch (25 mm). Apply finish coat of lagging adhesive over glass cloth or tape. Thin the finish coat to achieve smooth finish.

B. Apply insulation to flanges as follows:

1. Apply preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation segment the same as overall width of the flange and bolts, plus twice the thickness of the pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of block insulation of the same material and thickness as pipe insulation.
4. Finish flange insulation the same as pipe insulation.

C. Apply insulation to fittings and elbows as follows:

1. Apply premolded insulation sections of the same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When premolded sections of insulation are not available, apply mitered sections of calcium silicate insulation. Secure insulation materials with stainless-steel wire.
3. Finish insulation of fittings the same as pipe insulation.

D. Apply insulation to valves and specialties as follows:

1. Apply mitered segments of calcium silicate insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation. For check valves, arrange insulation for access to stainer basket without disturbing insulation.
2. Apply insulation to flanges as specified for flange insulation application.
3. Finish valve and specialty insulation the same as pipe insulation.

3.8 FIELD-APPLIED JACKET APPLICATION

- A. Apply canvas jacket, where indicated, directly over bare insulation or insulation with factory-applied jackets.
 1. Apply jacket smooth and tight to surface with 2-inch (50-mm) overlap at seams and joints.
 2. Embed canvas between two 0.062-inch- (1.6-mm-) thick coats of jacket manufacturer's recommended adhesive.
 3. Completely encapsulate insulation with jacket, leaving no exposed raw insulation.
- B. Foil and Paper Jackets: Apply foil and paper jackets where indicated.
 1. Draw jacket material smooth and tight.
 2. Apply lap or joint strips with the same material as jacket.
 3. Secure jacket to insulation with manufacturer's recommended adhesive.
 4. Apply jackets with 1-1/2-inch (40-mm) laps at longitudinal seams and 3-inch- (75-mm-) wide joint strips at end joints.
 5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-retarder mastic.

3.10 FINISHES

- A. Canvas Jacketed Insulation: Paint insulation finished with canvas jacket as specified in Division 9 Section "Painting."
- B. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

3.11 PIPING SYSTEM APPLICATIONS

- A. Insulation materials and thicknesses are specified in schedules at the end of this Section.
- B. Items Not Insulated: Unless otherwise indicated, do not apply insulation to the following systems, materials, and equipment:
 1. Flexible connectors.
 2. Vibration-control devices.
 3. Fire-suppression piping.
 4. Below-grade piping, unless otherwise indicated.

5. Air chambers, unions, strainers, check valves, plug valves, and flow regulators.

3.12 INSULATION APPLICATION SCHEDULE, GENERAL

- A. Refer to insulation application schedules for required insulation materials, vapor retarders, and field-applied jackets.
- B. Application schedules identify piping system and indicate pipe size ranges and material, thickness, and jacket requirements.

3.13 INTERIOR AND EXTERIOR ABOVEGROUND INSULATION APPLICATION SCHEDULE

See next page for schedule

INTERIOR AND EXTERIOR ABOVEGROUND INSULATION APPLICATION SCHEDULE							
Service	Operating Temperature	Insulation Material	Insulation Thickness	Field Applied Jacket	Vapor Retarder Required	Finish	Notes
Domestic cold water	35 to 75 deg F (2 to 20 deg C)	Mineral fiber	Note 1	Note 2	Yes	None	
Air-conditioning condensate drain piping	35 to 75 deg F (2 to 24 deg C)	Mineral fiber	Note 1	Note 2	Yes	None	
Chilled-water supply and return	35 to 75 deg F (2 to 24 deg C)	Mineral fiber	Note 1	Note 2	Yes	None	
Diesel-engine exhaust	0 to 1200 deg F (-18 to 650 Deg C)	Calcium silicate	Note 1	Note 3	Yes	Painted	

Note 1- Apply insulation thicknesses according to the Minimum Thickness Schedules located at the end of this section.

Note 2- a. Concealed applications: Foil and paper for mineral fiber. No jacket required for flexible elastomeric.

b. Exposed applications: Canvas jacket.

Note 3- a. Exposed applications: Canvas jacket.

3.14 THICKNESS SCHEDULE

See Schedule, next page

OTHER INTERIOR ABOVEGROUND SYSTEMS MINIMUM THICKNESS SCHEDULE							
		PIPE SIZES (NPS)					
Piping System Types	Fluid Temp. Range (Degrees F)	Branch Connections Up to 12 feet 1-1/4 & less	1 & less	1-1/4 to 2	2-1/2 to 4	5 & 6	8 to 24
Chilled water	40-55	0.5	1.5	1.5	1.5	1.5	2.0
Domestic water	35-180		1.0	1.0	1.0	1.0	1.0
Air-conditioning condensate	---	--	1.0	1.0	1.0	1.0	1.0
Diesel-engine exhaust	0-1200	--	—	—	2.0	2.0	2.0

EXTERIOR ABOVEGROUND MINIMUM THICKNESS SCHEDULE, ALL SYSTEMS						
PIPE SIZES (NPS)						
Piping System Types	Fluid Temp. Range (Degrees F)	1 & less	1-1/4 to 2	2-1/2 to 4	5 & 6	8 to 24
Chilled water	40-55	2.0	2.0	2.0	2.0	2.5
Domestic water	35-180	2.0	2.0	2.0	2.0	2.0

END OF SECTION 15083

SECTION 15110 - VALVES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following general-duty valves:
 - 1. Copper-alloy ball valves.
 - 2. Ferrous-alloy ball valves.
 - 3. Bronze swing check valves.
 - 4. Bronze gate valves.
 - 5. Bronze globe valves.
 - 6. Calibrated balancing valves.
- B. Related Sections include the following:
 - 1. Division 15 Section "Mechanical Identification" for valve tags and charts.
 - 2. Division 15 Section "HVAC Instrumentation and Controls" for control valves and actuators.
 - 3. Division 15 piping Sections for specialty valves applicable to those Sections only.

1.3 REFERENCED STANDARDS

- A. American Petroleum Institute
 - 1. API 594: Check Valves: Wafer, Wafer-Lug, and Double Flanged Type
- B. American Society for Testing and Materials
 - 1. ASTM B 32: Solder Metal
 - 2. ASTM B 813: Liquid and Paste Fluxes for Soldering Applications of Copper and Copper Alloy Tube
 - 3. ASTM B 828: Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings
- C. American Society of Mechanical Engineers
 - 1. ASME B1.20.1: Pipe Threads, General Purpose (Inch)
 - 2. ASME B16.1: Cast Iron Pipe Flanges and Flanged Fittings
 - 3. ASME B16.5: Pipe Flanges and Flanged Fittings
 - 4. ASME B16.10: Face-to-Face and End-to-End Dimensions of Valves
 - 5. ASME B16.18 (Reaffirmed 1994): Cast Copper Alloy Solder Joint Pressure Fittings

6. ASME B16.24: Cast Copper Alloy Pipe Flanges, Class 150, 300, 400, 600, 900, 1500, and 2500, and Flanged Fittings, Class 150 and 300.
 7. ASME B16.34: Valves-Flanges, Threaded, and Welding End
 8. ASME B31.1: Power Piping
 9. ASME B31.9: Building Services Piping
- D. American Water Works Association
1. AWWA C606: Grooved and Shouldered Joints
- E. Code of Federal Regulations (CFR)
1. 29 CFR 1910: Occupational Safety and Health Standards.
 2. 29 CFR 1910.147: Control of Hazardous Energy (Lock Out/Tag Out)
- F. Fluid Controls Institute
1. FCI 74-1: Spring Loaded Lift Disc Check Valve Standard
- G. Manufacturers Standardization Society of the Valve and Fittings Industry
1. MSS SP-45: Bypass and Drain Connections
 2. MSS SP-67: Butterfly Valves
 3. MSS SP-68: High Pressure Butterfly Valves with Offset Design
 4. MSS SP-70: Cast Iron Gate Valves, Flanged and Threaded Ends
 5. MSS SP-71: Gray Iron Swing Check Valves, Flanged and Threaded Ends
 6. MSS SP-72: Ball Valves with Flanged or Butt-Welding Ends for General Service
 7. MSS SP-78: Cast Iron Plug Valves, Flanged and Threaded Ends
 8. MSS SP-80: Bronze Gate, Globe, Angle and Check Valves
 9. MSS SP-85: Cast Iron Globe and Angle Valves, Flanged and Threaded Ends
 10. MSS SP-108: Resilient-Seated Cast Iron-Eccentric Plug Valves
 11. MSS SP-110: Ball Valves, Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends
- H. NSF International
1. NSF 61: Drinking Water System Components-Health Effects, Sections 1 through 9

1.4 DEFINITIONS

- A. The following are standard abbreviations for valves:
1. CWP: Cold working pressure.
 2. EPDM: Ethylene-propylene-diene terpolymer rubber.
 3. NBR: Acrylonitrile-butadiene rubber.
 4. PTFE: Polytetrafluoroethylene plastic.
 5. SWP: Steam working pressure.

6. TFE: Tetrafluoroethylene plastic.

1.5 SUBMITTALS

- A. Product Data: For each type of valve indicated. Include body, seating, and trim materials; valve design; pressure and temperature classifications; end connections; arrangement; dimensions; and required clearances. Include list indicating valve and its application. Include rated capacities; shipping, installed, and operating weights; furnished specialties; and accessories.

1.6 QUALITY ASSURANCE

- A. ASME Compliance: ASME B31.1 for power piping valves and ASME B31.9 for building services piping valves.
 1. Exceptions: Domestic hot- and cold-water[, sanitary waste, and storm drainage] piping valves unless referenced.
- B. ASME Compliance for Ferrous Valves: ASME B16.10 and ASME B16.34 for dimension and design criteria.
- C. NSF Compliance: NSF 61 for valve materials for potable-water service.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
 1. Protect internal parts against rust and corrosion.
 2. Protect threads, flange faces, grooves, and weld ends.
 3. Set angle, gate, and globe valves closed to prevent rattling.
 4. Set ball and plug valves open to minimize exposure of functional surfaces.
 5. Set butterfly valves closed or slightly open.
 6. Block check valves in either closed or open position.
- B. Use the following precautions during storage:
 1. Maintain valve end protection.
 2. Store valves indoors and maintain at higher than ambient dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.
- C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 VALVES, GENERAL

- A. Refer to Part 3 "Valve Applications" Article for applications of valves.

- B. Bronze Valves: NPS 2 (DN 50) and smaller with threaded ends, unless otherwise indicated.
- C. Ferrous Valves: NPS 2-1 (DN 65) and larger with flanged ends, unless otherwise indicated.
- D. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- E. Valve Sizes: Same as upstream pipe, unless otherwise indicated.
- F. Valve Actuators:
 - 1. Chainwheel: For attachment to valves, of size and mounting height, as indicated in the "Valve Installation" Article in Part 3.
 - 2. Gear Drive: For quarter-turn valves NPS 8 (DN 200) and larger.
 - 3. Handwheel: For valves other than quarter-turn types.
 - 4. Lever Handle: For quarter-turn valves NPS 6 (DN 150) and smaller, except plug valves.
 - 5. Wrench: For plug valves with square heads. Furnish Owner with 1 wrench for every 10 plug valves, for each size square plug head.
- G. Extended Valve Stems: On insulated valves.
- H. Valve Flanges: ASME B16.1 for cast-iron valves, ASME B16.5 for steel valves, and ASME B16.24 for bronze valves.
- I. Valve Ends:
 - 1. Solder Joint: With sockets according to ASME B16.18.
 - a. Caution: Use solder with melting point below 840 deg F (454 deg C) for angle, check, gate, and globe valves; below 421 deg F (216 deg C) for ball valves.
 - 2. Threaded: With threads according to ASME B1.20.1.

2.4 COPPER-ALLOY BALL VALVES

- A. Copper-Alloy Ball Valves, General: MSS SP-110.
- B. Two-Piece, Copper-Alloy Ball Valves: Class 150, Bronze body with full port for sizes NPS 1/2 (DN 15) and smaller and conventional-port for larger sizes, stainless steel ball, PTFE or TFE seats; and 600-psig (4140-kPa) minimum CWP rating and blowout-proof stainless steel stem. Vinyl covered steel lever handle with extension for insulation.
- C. Safety-Exhaust, Copper-Alloy Ball Valves: 29 CFR 1910.147, two-piece bronze body with exhaust vent opening, chrome-plated ball with vent, blowout-proof stem, locking handle, and working pressure rating for compressed air of at least 125 psig (860 kPa) of 600-psig (4140-kPa) CWP.

2.5 FERROUS-ALLOY BALL VALVES

- A. Ferrous-Alloy Ball Valves, General: MSS SP-72, with flanged ends.
- B. Ferrous-Alloy Ball Valves: Class 150, conventional port stainless steel ball and stem; TFE seats; 200-psig minimum CWP rating and blow-out-proof stem.

2.8 BRONZE SWING CHECK VALVES

- A. Bronze Check Valves, General: MSS SP-80.
- B. Class 125, 200 psi (1380 kPa) CWP, Bronze, Horizontal Swing Check Valves: Y-pattern, Bronze body with bronze disc and seat. Renewable seat and disc.
- C. Class 300, 600 psi (4140 kPa) CWP, Bronze, Horizontal Swing Check Valves: Y-pattern, Bronze body with bronze disc and seat. Renewable seat and disc.

2.12 BRONZE GATE VALVES

- A. Bronze Gate Valves, General: MSS SP-80, with ferrous-alloy handwheel.

2.15 BRONZE GLOBE VALVES

- A. Bronze Globe Valves, General: MSS SP-80, with ferrous-alloy handwheel.
- B. Class 125, Bronze Globe Valves: Bronze body with bronze disc and TFE renewable seat.

2.19 CALIBRATED BALANCING VALVES

- A. Calibrated Balancing Valves, NPS 2 (DN 50) and smaller: Bronze body, **[ball or]** globe type, 125-psig (860-kPa) working pressure, 250 deg F (121 deg C) maximum operating temperature, and having threaded ends. Valves: Calibrated port **[venturi or]** globe style connections for portable differential pressure meter with integral seals, and equipped with memory stop to retain set position.
- B. Calibrated Balancing Valves, NPS 2-1/2 (DN 65) and larger: Cast-iron body, **[ball or]** globe type, 125-psig (860-kPa) working pressure, 250 deg F (121 deg C) maximum operating temperature, and having flanged connections. Valves: Calibrated port **[venturi or]** globe style connections for portable differential pressure meter with integral seals, and be equipped with memory stop to retain set position.

2.20 CHAINWHEEL ACTUATORS

- A. Description: Valve actuation assembly with sprocket rim, brackets, and chain.
 - 1. Sprocket Rim with Chain Guides: Ductile iron or Cast iron, of type and size required for valve. Include zinc coating.

2. Brackets: Type, number, size, and fasteners required to mount actuator on valve.
3. Chain: Hot-dip, galvanized steel, of size required to fit sprocket rim.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine piping system for compliance with requirements for installation tolerances and other conditions affecting performance.
 1. Proceed with installation only after unsatisfactory conditions have been corrected.
- B. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- C. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- D. Examine threads on valve and mating pipe for form and cleanliness.
- E. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- F. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE APPLICATIONS

- A. Refer to piping Sections for specific valve applications. If valve applications are not indicated, use the following:
 1. Shutoff Service: Ball or gate valves.
 2. Throttling Service: Globe valves or calibrated balancing valves.
- B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP class or CWP ratings may be substituted.
- C. Select valves, except wafer and flangeless types, with the following end connections:
 1. For Copper Tubing, NPS 2DN 50 and Smaller: Solder-joint or threaded ends, except provide valves with threaded ends for heating hot water, steam, and steam condensate services.
 2. For Copper Tubing, NPS 2-1/2 to NPS 4DN 65 to DN 100: Flanged ends.
 3. For Copper Tubing, NPS 5DN 125 and Larger: Flanged ends.
 4. For Steel Piping, NPS 2DN 50 and Smaller: Threaded ends.
 5. For Steel Piping, NPS 2-1/2 to NPS 4DN 65 to DN 100: Flanged ends.
 6. For Steel Piping, NPS 5DN 125 and Larger: Flanged ends.

- D. See valve application table at end of section.

3.3 VALVE INSTALLATION

- A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- C. Locate valves for easy access and provide separate support where necessary.
- D. Install valves in horizontal piping with stem at or above center of pipe.
- E. Install valves in position to allow full stem movement.
- F. Install chainwheel operators on valves NPS 4 (DN 100) and larger and more than 84 inches (2150 mm) above floor. Extend chains to 72 inches (1800 mm) above finished floor elevation.
- G. Install check valves for proper direction of flow and as follows:
 - 1. Swing Check Valves: In horizontal position with hinge pin level.
- H. Locate and install calibrated balancing valves to provide 5 pipe diameters straight inlet and 2 pipe diameters straight outlet.

3.4 JOINT CONSTRUCTION

- A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.

3.5 ADJUSTING

- A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.6 SCHEDULES

See following pages for Valve Application Table

VALVE APPLICATION TABLE			
Valve Types	Applications	Chilled Water Piping	Domestic Water Piping
Ball Valves, NPS 2 (DN 50) and Smaller: Two-piece, 600-psig (4140-kPa) CWP rating, copper alloy		1.	1.
Swing Check Valves, NPS 2 (DN 50) and Smaller: Class 125, bronze.			3.
Gate Valves, NPS 2 (DN 50) and Smaller: Class 125, bronze			1.
Gate Valves, NPS 2-1/2 (DN 65) and Larger: Class 125, OS&Y, bronze-mounted cast iron		1.	1.
Calibrated Balancing Valves, NPS 2 (DN 50) and smaller: Bronze body, ball or globe type, 125-psig (860-kPa) working pressure, 250 deg F (121 deg C) maximum operating temperature, and having threaded ends. Valves: Calibrated port Venturi or globe style connections for portable differential pressure meter with integral seals, and equipped with memory stop to retain set position		2.	2.

Notes:

1. For shutoff duty.
2. For balancing or throttling duty.
3. In gravity lines or horizontal domestic water lines only.

END OF SECTION

SECTION 15122 - METERS AND GAGES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following meters and gages for mechanical systems:
 - 1. Thermometers.
 - 2. Gages.
 - 3. Test plugs.
- B. Related Sections include the following:
 - 1. Division 15 Section "Hydronic Piping" for chilled water systems.

1.3 REFERENCED STANDARDS

- A. ASME International:
 - 1. ASME B40.3: Bimetallic Actuated Thermometers.
 - 2. ASME B40.100: Pressure Gauges and Gauge Attachments.

1.4 DEFINITIONS

- A. EPDM: Ethylene-propylene-diene terpolymer rubber.

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated; include performance curves.
- B. Shop Drawings: Schedule for thermometers, gages, and flowmeters indicating manufacturer's number, scale range, and location for each. Include upstream and downstream straight pipe requirements for each flowmeter. Include scaled drawings indicating flow meter locations in piping systems.
- C. Product Certificates: For each type of thermometer, gage, and flowmeter, signed by product manufacturer.
- D. Operation and Maintenance Data: Include submittals, parts list, and operating data for meters and gauges in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 METAL-CASE, LIQUID-IN-GLASS THERMOMETERS

- A. Case: Die-cast aluminum, 9 inches (229 mm) long.
- B. Tube: Red or blue reading, organic-liquid filled, with magnifying lens.
- C. Tube Background: Satin-faced, nonreflective aluminum with permanently etched scale markings.
- D. Window: Glass.
- E. Connector: Adjustable type, 180 degrees in vertical plane, 360 degrees in horizontal plane, with locking device.
- F. Stem: Copper-plated steel, aluminum, or brass for thermowell installation and of length to suit installation.
- G. Accuracy: Plus or minus 1 percent of range or plus or minus 1 scale division to maximum of 1.5 percent of range.

2.2 THERMOWELLS

- A. Manufacturers: Same as manufacturer of thermometer being used.
- B. Description: Pressure-tight, socket-type metal fitting made for insertion into piping and of type, diameter, and length required to hold thermometer. Provide extension neck length suitable for insulation thickness. Suitable for system fluid and working pressure.

2.3 PRESSURE GAGES

- A. Direct-Mounting, Dial-Type Pressure Gages: Indicating-dial type complying with ASME B40.100.
 - 1. Case: Dry type, drawn steel or cast aluminum, 4-1/2-inch (114-mm) diameter.
 - 2. Pressure-Element Assembly: Bourdon tube, unless otherwise indicated.
 - 3. Pressure Connection: Brass, NPS 1/4 (DN 8), bottom-outlet type unless back-outlet type is indicated.
 - 4. Movement: Mechanical, with link to pressure element and connection to pointer.
 - 5. Dial: Satin-faced, nonreflective aluminum with permanently etched scale markings.
 - 6. Pointer: Red metal.
 - 7. Window: Glass.
 - 8. Ring: Stainless steel.
 - 9. Accuracy: Grade A, plus or minus 1 percent of middle half scale.
 - 10. Vacuum-Pressure Range: 30-in. Hg of vacuum to 15 psig of pressure (100 kPa of vacuum to 103 kPa of pressure).
 - 11. Range for Fluids under Pressure: Two times operating pressure.
- B. Pressure-Gage Fittings: Suitable for system fluid and working pressure.

1. Valves: NPS 1/4 (DN 8) brass or stainless-steel needle type.
2. Syphons: NPS 1/4 (DN 8) coil of brass tubing with threaded ends.
3. Snubbers: ASME B40.5, NPS 1/4 (DN 8) brass bushing with corrosion-resistant, porous-metal disc of material suitable for system fluid and working pressure.

2.4 TEST PLUGS

- A. Description: Corrosion-resistant brass or stainless-steel body with core inserts and gasketed and threaded cap, with extended stem for units to be installed in insulated piping.
- B. Minimum Pressure and Temperature Rating: 500 psig at 275 deg F (3450 kPa at 136 deg C).
- C. Core Insert: One or two self-sealing rubber valves.
 1. Insert material for air or water service at minus 30 to plus 275 deg F (minus 35 to plus 136 deg C) shall be EPDM or Nordel.
- D. Test Kit: Furnish one test kit containing one pressure gage and adaptor, two thermometers, and carrying case. Pressure gage, adapter probes, and thermometer sensing elements shall be of diameter to fit test plugs and of length to project into piping.
 1. Pressure Gage: Small bourdon-tube insertion type with 3-inch- (76-mm-) diameter dial. Adapter probe of suitable size and diameter. Dial range shall be 0 to 200 psig (0 to 1380 kPa).
 2. Low-Range Thermometer: Small bimetallic insertion type with 2-inch- (51-mm-) diameter dial and tapered-end sensing element. Dial ranges shall be 25 to 125 deg F (minus 4 to plus 52 deg C).
 3. High-Range Thermometer: Small bimetallic insertion type with 2-inch- (51-mm-) diameter dial and tapered-end sensing element. Dial ranges shall be 0 to 220 deg F (minus 18 to plus 104 deg C).
 4. Carrying case shall have formed instrument padding.

PART 3 - EXECUTION

3.1 THERMOMETER APPLICATIONS

- A. Install thermometers in the following locations and as indicated on the drawings:
 1. Inlet and outlet of domestic hot water generators/heaters.
 2. Inlet and outlet of each hydronic boiler and chiller.
 3. Inlet and outlet of each hydronic coil in air-handling units.
 4. Inlet and outlet of each hydronic heat exchanger.
- B. Provide the following temperature ranges for thermometers:
 1. Domestic Cold Water: 30 to 180 deg F, with 2-degree scale divisions (Minus 1 to plus 82 deg C, with 1-degree scale divisions).

2. Chilled Water: 0 to 100 deg F, with 2-degree scale divisions (Minus 18 to plus 38 deg C, with 1-degree scale divisions).

3.2 GAGE APPLICATIONS

- A. Install pressure gages in locations indicated on the drawings.

3.3 INSTALLATIONS

- A. Install direct-mounting thermometers and adjust vertical and tilted positions.
- B. Install thermowells with socket extending a minimum of 2.5 inches (63.5) mm into fluid and in vertical position in piping tees where thermometers are required.
- C. Install pressure gages in piping tees with pressure gage located on pipe at most readable position, where pressure gages are required and as indicated.
- D. Install needle-valve and snubber fitting in piping for each pressure gage for fluids (except steam).
- E. Install needle-valve and syphon fitting in piping for each pressure gage for steam.
- F. Install test plugs in tees in piping where indicated.

3.4 CONNECTIONS

- A. Install meters and gages adjacent to machines and equipment to allow service and maintenance for meters, gages, machines, and equipment.

3.5 ADJUSTING

- A. Calibrate meters according to manufacturer's written instructions, after installation.
- B. Adjust faces of meters and gages to proper angle for best visibility.

END OF SECTION 15122

SECTION 15140 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes domestic water piping inside the building.
- B. Related Sections include the following:
 - 1. Division 7 Section "Through-Penetration Firestop Systems" for fire-barrier sealers.
 - 2. Division 15 Section "Meters and Gages" for thermometers, pressure gages, and fittings.
 - 3. Division 15 Section "Plumbing Specialties" for water distribution piping specialties.
 - 4. Division 15 Section "Valves" for general-duty valves not specified in Section 15140.

1.3 REFERENCED STANDARDS

- A. American Society for Testing and Materials
 - 1. ASTM B 32: Solder Metal
 - 2. ASTM B 75: Seamless Copper Tube
 - 3. ASTM B 75M: Seamless Copper Tube [Metric]
 - 4. ASTM B 88: Seamless Copper Water Tube
 - 5. ASTM A 88M: Seamless Copper Water Tube [Metric]
 - 6. ASTM B 584: Copper Alloy Sand Castings for General Applications
 - 7. ASTM B 813: Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube
 - 8. ASTM B 828: Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings
- B. American Water Works Association
 - 1. AWWA C651: Disinfecting Water Mains
- C. ASME International
 - 1. ASME B16.18: Cast Copper Alloy Solder Joint Pressure Fittings.
 - 2. ASME B16.22: Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
 - 3. ASME B16.24: Cast Copper Alloy Pipe Flanges, Class 150, 300, 400, 600, 900, 1500, and 2500, and Flanged Fittings, Class 150 and 300.

- D. Copper Development Association, Inc.
 - 1. Copper Tube Handbook. 1995.
- E. Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.
 - 1. MSS SP-69: Pipe Hangers and Supports - Selection and Application
 - 2. MSS SP-123: Non-Ferrous Threaded and Solder-Joint Unions for Use with Copper Water Tube.
- F. NSF International
 - 1. NSF 61-01: Drinking Water System Components - Health Effects.

1.4 PERFORMANCE REQUIREMENTS

- A. Provide components and installation of domestic water piping systems with a minimum working-pressure rating of 125 psig (860 kPa), unless otherwise indicated.

1.5 SUBMITTALS

- A. Product Data: For pipe, tube, fittings, and couplings.
- B. Water Samples: Specified in Part 3 "Cleaning" Article.
- C. Field quality-control test reports.

1.6 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9," for potable domestic water piping and components.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Refer to Part 3 "Pipe and Fitting Applications" Article for applications of pipe, tube, fitting, and joining materials.
- B. Transition Couplings for Aboveground Pressure Piping: Coupling or other manufactured fitting the same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

2.2 COPPER TUBE AND FITTINGS

- A. Hard Copper Tube: ASTM B 88, Type K (ASTM B 88M, Type A), water tube, drawn temper.
 - 1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
 - 2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
 - 3. Copper Unions: ASME B16.18, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint ends.
 - 4. Elbows in piping NPS 4 (DN 100) and larger shall be long radius type.

2.3 VALVES

- A. Bronze and cast-iron, general-duty valves are specified in Division 15 Section "Valves."
- B. Balancing and drain valves are specified in Division 15 Section "Plumbing Specialties."

PART 3 - EXECUTION

3.1 PIPE AND FITTING APPLICATIONS

- A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.
- B. Flanges may be used on aboveground piping, unless otherwise indicated.
- C. Aboveground Domestic Water Piping: Use any of the following piping materials for each size range:
 - 1. NPS 4 (DN 100) and Smaller: Hard copper tube, Type K (Type A); copper pressure fittings; and soldered joints.
 - 2. NPS 5 (DN 125) and larger: Hard copper tube, Type K (Type B); copper pressure fittings; and soldered joints.
- D. Non-Potable-Water Piping: Use any of the following piping materials for each size range:
 - 1. NPS 4 (DN 100) and Smaller: Hard copper tube, Type K (Type A); copper pressure fittings; and soldered joints.
 - 2. NPS 5 (DN 125) and larger: Hard copper tube, Type K (Type B); copper pressure fittings; and soldered joints.

3.2 VALVE APPLICATIONS

- A. General-Duty Valve Applications: Unless otherwise indicated, use the following valve types:
 - 1. Shutoff Duty: Use bronze ball or gate valves for piping NPS 2 (DN 50) and smaller. Use cast-iron gate valves with flanged ends for piping NPS 2-1/2 (DN 65) and larger.

2. Throttling Duty: Use bronze globe valves for piping NPS 2 (DN 50) and smaller. Use cast-iron globe valves with flanged ends for piping NPS 2-1/2 (DN 65) and larger.
 3. Drain Duty: Hose-end drain valves with vacuum breakers.
- B. Install shutoff valve close to water main on each branch and riser serving plumbing fixtures or equipment, on each water supply to equipment, and on each water supply to plumbing fixtures that do not have supply stops.
- C. Install drain valves for equipment at base of each water riser, at low points in horizontal piping, and where required to drain water piping.

3.3 PIPING INSTALLATION

- A. Basic piping installation requirements are specified in Division 15 Section "Basic Mechanical Materials and Methods."
- B. Install shutoff valves, hose-end drain valve, basket strainer, pressure gages, backflow preventer, and plumbing specialties as indicated on the drawings, inside the building at each domestic water service entrance. Pressure gages are specified in Division 15 Section "Meters and Gages," and drain valves, strainers, and backflow preventers are specified in Division 15 Section "Plumbing Specialties."
- C. Install domestic water piping level without pitch and plumb.
- D. Provide dielectric fittings between dissimilar metals.

3.4 JOINT CONSTRUCTION

- A. Basic piping joint construction requirements are specified in Division 15 Section "Basic Mechanical Materials and Methods."
- B. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

3.6 HANGER AND SUPPORT INSTALLATION

- A. Pipe hanger and support devices are specified in Division 15 Section "Hangers and Supports." Install the following:
1. Vertical Piping: MSS Type 8 or Type 42, clamps.
 2. Individual, Straight, Horizontal Piping Runs: According to the following:
 - a. 100 Feet (30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than 100 Feet (30 m): MSS Type 43, adjustable roller hangers.
 - c. Longer Than 100 Feet (30 m): MSS Type 49, spring cushion rolls, if indicated.

3. Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- B. Install supports according to Division 15 Section "Hangers and Supports."
- C. Support vertical piping and tubing at base and at each floor.
- D. Rod diameter may be reduced 1 size for double-rod hangers, to a minimum of 3/8 inch (10 mm).
- E. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
1. NPS 3/4 (DN 20) and Smaller: 60 inches (1500 mm) with 3/8-inch (10-mm) rod.
 2. NPS 1 and NPS 1-1/4 (DN 25 and DN 32): 72 inches (1800 mm) with 3/8-inch (10-mm) rod.
 3. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 96 inches (2400 mm) with 3/8-inch (10-mm) rod.
 4. NPS 2-1/2 (DN 65): 108 inches (2700 mm) with 1/2-inch (13-mm) rod.
 5. NPS 3 to NPS 5 (DN 80 to DN 125): 10 feet (3 m) with 1/2-inch (13-mm) rod.
- F. Install supports for vertical copper tubing every 10 feet (3 m).

3.8 CONNECTIONS

- A. Install domestic water piping as shown on the drawings and in accordance with the provisions of Division 15 Section "Basic Mechanical Materials and Methods."
- B. Install piping adjacent to equipment and machines to allow service and maintenance.
- C. Use dielectric fitting to join dissimilar piping materials.
- D. Connect domestic water piping to water-service piping at shutoff valve, and extend and connect to the following:
1. Equipment: Cold-water supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 (DN 65) and larger.

3.9 FIELD QUALITY CONTROL

- A. Inspect domestic water piping as follows:
1. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.

2. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
 - a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 - b. Final Inspection: Arrange final inspection for authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
 3. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
 4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- B. Test domestic water piping as required under Division 15 Section “Basic Mechanical Materials and Methods.”

3.10 ADJUSTING

- A. Perform the following adjustments before operation:
1. Close drain valves, hydrants, and hose bibbs.
 2. Open shutoff valves to fully open position.
 3. Open throttling valves to proper setting.
 4. Remove plugs used during testing of piping and plugs used for temporary sealing of piping during installation.
 5. Remove and clean strainer screens. Close drain valves and replace drain plugs.

3.11 CLEANING AND DISINFECTING

- A. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.
- B. Clean and disinfect potable and non-potable domestic water piping as follows:
1. Flush new piping and parts of existing domestic water piping that have been altered, extended, or repaired before using.
 2. Use flushing and disinfecting procedures prescribed by authorities having jurisdiction or as described below:
 3. Disinfect the entire domestic water system installed under this contract, cold, hot and return piping, before using as follows:
 - a. Through a NPS 0.75 (DN 20) hose connection in the main entering the building, pump in sufficient sodium hypochlorite to produce a free available chlorine residual of not less than 200 ppm. Provide plumbing connections and power for service organization for pumping chlorine into the system.

- b. Proceed upstream from the point of chlorine application, opening each faucet and tap until chlorine is detected. Close each faucet and tap when chlorine is evident.
- c. When chlorinated water has been brought to every faucet and tap with a minimum concentration of 200 ppm chlorine, retain this water in the system for at least three hours, but no more than 3.5 hours.
- d. At the end of the retention period, no less than 100 ppm of chlorine shall be present at the extreme end of the system.
- e. Open all faucets and taps and flush all lines until the chlorine residual in the water is less than one ppm.
- f. Obtain a representative water sample from the system for analysis by a recognized bacteriological laboratory.
- g. If the sample tested for coliform organisms is negative, the service organization shall submit a letter and laboratory report to the Contractor, certifying successful completion of the sterilization. Submit report.
- h. If any samples tested indicate the presence of coliform organisms, the entire sterilization procedure shall be repeated.
- i. Close main sprinkler valves or branch sprinkler valves prior to disinfection of system. Open valves when disinfection is complete.

C. Prepare and submit reports of flushing and disinfecting activities.

END OF SECTION 15140

SECTION 15150 - SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following for soil, waste, and vent piping inside the building:
 - 1. Pipe, tube, and fittings.
 - 2. Special pipe fitting.
 - 3. Encasement for underground metal piping.
- B. Related Sections include the following:
 - 1. Division 7 Section "Through-Penetration Firestop Systems" for fire-barrier sealers.

1.3 REFERENCED STANDARDS

- A. American Water Works Association
 - 1. AWWA C105: Polyethylene Encasement for Ductile-Iron Pipe Systems
 - 2. AWWA C110: Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In. (75 mm through 1200 mm), for Water and Other Liquids
 - 3. AWWA C111: Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
 - 4. AWWA C151: Ductile-Iron Pipe Centrifugally Cast, for Water
 - 5. AWWA C153: Ductile-Iron Compact fittings for Water Service
 - 6. AWWA C219: Bolted, Sleeve-Type Couplings for Plain-End Pipe
 - 7. AWWA C600: Installation of Ductile-Iron Water Mains and Their Appurtenances
 - 8. AWWA C606: Grooved and Shouldered Joints
- B. ASME International
 - 1. ASME B16.1: Cast Iron Pipe Flanges and Flanged Fittings
 - 2. ASME B 16.4: Gray Iron Threaded Fittings
 - 3. ASME B16.12: Cast Iron Threaded Drainage Fittings
 - 4. ASME B16.18: Cast Copper Alloy Solder Joint Pressure Fitting
 - 5. ASME B16.22: Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
 - 6. ASME B16.23: Cast Copper Alloy Solder Joint Drainage Fittings (DWV)
 - 7. ASME B16.24: Cast Copper Alloy Pipe Flanges, Class 150, 300, 400, 600, 900, 1500, and 2500, and Flanged Fittings, Class 150 and 300
 - 8. ASME B16.29: Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV
 - 9. ASME B16.39: Malleable Iron Threaded Pipe Unions

C. ASTM International

1. ASTM A 47/A 47M: Specification for Ferritic Malleable Iron Castings
2. ASTM A 48/A 48M: Specification for Gray Iron Castings
3. ASTM A 74: Specification for Cast Iron Soil Pipe and Fittings
4. ASTM A 536: Specification for Ductile Iron Castings
5. ASTM A 674: Practice for Polyethylene Encasement for Ductile Iron Pipe for Water or Other Liquids
6. ASTM A 888: Specification Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications
7. ASTM B 32: Specification for Solder Metal
8. ASTM B 88: Specification for Seamless Copper Water Tube
9. ASTM B 88M: Specification for Seamless Copper Water Tube [Metric]
10. ASTM B 306: Specification for Copper Drainage Tube (DWV)
11. ASTM B 813: Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube
12. ASTM B 828: Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings
13. ASTM C 564: Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings
14. ASTM C 1173: Specification for Flexible Transition Couplings for Underground Piping Systems
15. ASTM C 1277: Specification for Shielded Couplings Joining Hubless Cast Iron Soil Pipe and Fittings
16. ASTM C 1440: Specification for Thermoplastic Elastomeric (TPE) Gasket Materials for Drain, Waste, and Vent (DWV), Sewer, Sanitary and Storm Plumbing Systems
17. ASTM C 1460: Specification for Shielded Transition Couplings for Use with Dissimilar DWV Pipe and Fittings Above Ground
18. ASTM C 1461: Specification for Mechanical Couplings Using Thermoplastic Elastomeric (TPE) Gaskets for Joining Drain, Waste, and Vent (DWV), Sewer, Sanitary, and Storm Plumbing Systems for above and below Ground Use

D. Cast Iron Soil Pipe Institute

1. CISPI 301: Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications
2. CISPI 310: Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications
3. Cast Iron Soil Pipe and Fittings Handbook

E. Copper Development Association Inc.

1. Copper Tube Handbook

F. Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1. MSS SP-69: Pipe Hangers and Supports - Selection and Application

2. MSS SP-123: Non-Ferrous Threaded and Solder-Joint Unions for Use with Copper Water Tube

1.4 DEFINITIONS

- A. LLDPE: Linear, low-density polyethylene plastic.
- B. PE: Polyethylene plastic.

1.5 PERFORMANCE REQUIREMENTS

- A. Components and installation shall be capable of withstanding the following minimum working pressure, unless otherwise indicated:
 1. Soil, Waste, and Vent Piping: 10-foot head of water (30 kPa).
 2. Sanitary Sewer, Force-Main Piping: 100 psig (690 kPa).

1.6 SUBMITTALS

- A. Product Data: For pipe, tube, fittings, and couplings.
- B. Field quality-control inspection and test reports.

1.7 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.
- B. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for transition fittings.

2.2 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 74, Service class.
- B. Gaskets: ASTM C 564, rubber.

2.3 HUBLESS CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 888 or CISPI 301.

- B. Shielded Couplings: ASTM C 1277 assembly of metal shield or housing, corrosion-resistant fasteners, and rubber sleeve with integral, center pipe stop.
 - 1. Standard, Shielded, Stainless-Steel Couplings: CISPI 310, with 24-gauge, 300 series stainless-steel corrugated shield; two stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve.
 - 2. Heavy-Duty, Shielded, Stainless-Steel Couplings: With minimum 24 gauge stainless-steel shield, minimum of four stainless-steel bands and tightening devices, and ASTM C 564, rubber sleeve.

2.4 COPPER TUBE AND FITTINGS

- A. Copper DWV Tube: ASTM B 306, drainage tube, drawn temper.
 - 1. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought copper, solder-joint fittings.
- B. Hard Copper Tube: ASTM B 88, Types L and M (ASTM B 88M, Types B and C), water tube, drawn temper.
 - 1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
 - 2. Copper Flanges: ASME B16.24, Class 150, cast copper with solder-joint end.
 - 3. Copper Unions: MSS SP-123, copper-alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

- A. Flanges and unions may be used on aboveground pressure piping, unless otherwise indicated.
- B. Restrictions on locations: Cast-iron, no-hub piping is not permitted over food preparation, storage, serving, or dining areas. Use cast-iron hub and spigot piping with rubber gasketed joints, or copper piping with soldered joints.
- C. Aboveground, soil, waste, and vent piping shall be any of the following:
 - 1. Hubless cast-iron soil pipe and fittings; standard, shielded, stainless-steel couplings; and hubless-coupling joints.
 - 2. Copper DWV tube, copper drainage fittings, and soldered joints.
- D. Underground, soil, waste, and vent piping shall be the following:
 - 1. Service class, hub and spigot cast-iron soil piping; rubber gaskets; and gasketed joints.

3.2 PIPING INSTALLATION

- A. Basic piping installation requirements are specified in Division 15 Section "Basic Mechanical Materials and Methods."
- B. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.
- C. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
 - 1. Brace piping NPS 5 (DN 125) and larger according to CISPI standards.
 - 2. Install encasement on underground piping according to ASTM A 674 or AWWA C105.
- D. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if 2 fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
- E. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.
- F. Install soil and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated:
 - 1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 (DN 80) and smaller; 1 percent downward in direction of flow for piping NPS 4 (DN 100) and larger.
 - 2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
 - 3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.
- G. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.
- H. Do not enclose, cover, or put piping into operation until it is inspected, tested and approved by authorities having jurisdiction.

3.3 JOINT CONSTRUCTION

- A. Basic piping joint construction requirements are specified in Division 15 Section "Basic Mechanical Materials and Methods."
- B. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
- C. Join hubless cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-coupling joints.
- D. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

3.4 HANGER AND SUPPORT INSTALLATION

- A. Pipe hangers and supports are specified in Division 15 Section "Hangers and Supports." Install the following:
 - 1. Vertical Piping: MSS Type 8 or Type 42, clamps.
 - 2. Install individual, straight, horizontal piping runs according to the following:
 - a. 100 Feet (30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than 100 Feet (30 m): MSS Type 43, adjustable roller hangers.
 - c. Longer Than 100 Feet (30 m), if Indicated: MSS Type 49, spring cushion rolls.
 - 3. Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 - 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- B. Install supports according to Division 15 Section "Hangers and Supports."
- C. Support vertical piping and tubing at base and at each floor.
- D. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch (10-mm) minimum rods.
- E. Install hangers for cast-iron no-hub soil piping within 18 inches (460 mm) of each horizontal joint, with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 60 inches (1500 mm) with 3/8-inch (10-mm) rod.
 - 2. NPS (DN 80): 60 inches (1500 mm) with 1/2-inch (13-mm) rod.
 - 3. NPS 4 and NPS 5 (DN 100 and DN 125): 60 inches (1500 mm) with 5/8-inch (16-mm) rod.
 - 4. NPS (DN 150): 60 inches (1500 mm) with 3/4-inch (19-mm) rod.
 - 5. NPS 8 to NPS 12 (DN 200 to DN 300): 60 inches (1500 mm) with 7/8-inch (22-mm) rod.

- F. Install supports for vertical cast-iron soil piping every 15 feet (4.5 m).
- G. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/4 (DN 32): 72 inches (1800 mm) with 3/8-inch (10-mm) rod.
 - 2. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 96 inches (2400 mm) with 3/8-inch (10-mm) rod.
 - 3. NPS 2-1/2 (DN 65): 108 inches (2700 mm) with 1/2-inch (13-mm) rod.
 - 4. NPS 3 to NPS 5 (DN 80 to DN 125): 10 feet (3 m) with 1/2-inch (13-mm) rod.
 - 5. NPS 6 (DN 150): 10 feet (3 m) with 5/8-inch (16-mm) rod.
 - 6. NPS 8 (DN 200): 10 feet (3 m) with 3/4-inch (19-mm) rod.
- H. Install supports for vertical copper tubing every 10 feet (3 m).

3.5 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

3.6 CONNECTING TO EXISTING PIPING

- A. Clean the inside of existing piping at connections to new piping, using water blasting device.
- B. Blasting device: Flexible high pressure hose with self-propelling nozzle which blasts to front, sides, and rear (propulsion).
- C. Operation: Blasting device is operated with water at 15,000 psi (10⁷ kPa). The piping system being cleaned is not pressurized.
- D. Clean from the connection point to at least 5 feet (1.5 m) outside the exterior building wall.

3.7 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
 - 1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 - 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

- D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
 2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping, except outside leaders, on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water (30 kPa). From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
 4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg (250 Pa). Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
 5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
 6. Prepare reports for tests and required corrective action.

3.8 CLEANING

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.

END OF SECTION 15150

SECTION 15181 - HYDRONIC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes piping and hydronic specialties for hot-water heating, chilled-water cooling, and condenser water systems; and blowdown drain lines.
- B. Related Sections include the following:
 - 1. Division 7 Section "Through-Penetration Firestop Systems" for materials and methods for sealing pipe penetrations through fire and smoke barriers.
 - 2. Division 15 Section "Basic Mechanical Materials and Methods" for general piping materials and installation requirements.
 - 3. Division 15 Section "Hangers and Supports" for pipe supports, product descriptions, and installation requirements.
 - 4. Division 15 Section "Valves" for gate, globe, ball, butterfly, check, and special-duty valves.
 - 5. Division 15 Section "Meters and Gages" for thermometers, flow meters, and pressure gages.
 - 6. Division 15 Section "Mechanical Identification" for labeling and identifying hydronic piping.
 - 7. Division 15 Section "HVAC Instrumentation and Controls" for temperature-control valves and sensors.

1.3 REFERENCED STANDARDS

- A. ASTM International:
 - 1. ASTM A 47: Specification for Ferritic Malleable Iron Castings
 - 2. ASTM A 47M: Specification for Ferritic Malleable Iron Castings [Metric]
 - 3. ASTM A 53: Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
 - 4. ASTM A 106: Specification for Seamless Carbon Steel Pipe for High-Temperature Service
 - 5. ASTM A 126: Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings
 - 6. ASTM A 234/A 234M: Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service
 - 7. ASTM A 536: Specification for Ductile Iron Castings
 - 8. ASTM A 733: Specification for Welded and Seamless Carbon Steel and Austenitic Stainless Steel Pipe Nipples

9. ASTM B 32: Specification for Solder Metal
10. ASTM B 88: Specification for Seamless Copper Water Tube
11. ASTM B88M: Specification for Seamless Copper Water Tube [Metric]

B. ASME International:

1. ASME B16.1: Cast Iron Pipe Flanges and Flanged Fittings
2. ASME B16.3: Malleable Iron Threaded Fittings
3. ASME B16.4: Cast-Iron Threaded Fittings
4. ASME B16.5: Pipe Flanges and Flanged Fittings, NPS1/2 to NPS 24
5. ASME B16.22: Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
6. ASME B16.39: Malleable Iron Threaded Pipe Unions
7. ASME B31.9: Building Services Piping
8. ASME Boiler and Pressure Vessel Code: Section II, Part C, "Welding Rods, Electrodes, and Filler Metals"; Section IV, "Heating Boilers"; Section VIII, "Pressure Vessels"; Section IX, "Welding and Brazing Qualifications"

C. American Welding Society

1. AWS A5.8: Specification for Filler Metals for Brazing and Braze Welding

D. Manufacturers Standardization Society of the Valve and Fittings Industry

1. MSS SP-58: Pipe Hangers and Supports—Materials, Design and Manufacture

1.4 SUBMITTALS

A. Product Data: For each product specified.

B. Shop Drawings: Detail fabrication of pipe anchors, hangers, special pipe support assemblies, alignment guides, expansion joints and loops, and their attachment to the building structure. Detail location of anchors, alignment guides, and expansion joints and loops.

C. Field Test Reports: Written reports of tests specified in Part 3 of this Section. Include the following:

1. Test procedures used.
2. Test results that comply with requirements.
3. Failed test results and corrective action taken to achieve requirements.

D. Maintenance Data: For hydronic specialties and special-duty valves to include in maintenance manuals specified in Division 1.

1.5 QUALITY ASSURANCE

A. Welding: Refer to Division 15 Section "Basic Mechanical Materials and Methods" for welding requirements.

- B. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1.

1.6 COORDINATION

- A. Coordinate layout and installation of hydronic piping and suspension system components with other construction, including light fixtures, HVAC equipment, fire-suppression-system components, and partition assemblies.
- B. Coordinate pipe fitting pressure classes with products specified in related Sections.
- C. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into base. Concrete, reinforcement, and formwork requirements are specified in Division 3 Sections.
- D. Coordinate installation of pipe sleeves for penetrations through exterior walls and floor assemblies. Coordinate with requirements for firestopping specified in Division 7 Section "Through-Penetration Firestop Systems" for fire and smoke wall and floor assemblies.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. General: Refer to Part 3 "Piping Applications" Article for applications of pipe and fitting materials.

2.2 COPPER TUBE AND FITTINGS

- A. Drawn-Temper Copper Tubing: ASTM B 88, Type L (ASTM B 88M, Type B).
- B. Wrought-Copper Fittings: ASME B16.22.
- C. Wrought-Copper Unions: ASME B16.22.
- D. Solder and brazing Filler Metals: Refer to Division 15 Section "Basic Mechanical Materials and Methods" for soldering and brazing requirements.

2.3 STEEL PIPE AND FITTINGS

- A. Steel Pipe, NPS 2 (DN 50) and Smaller: ASTM A 53, Type S (seamless) or Type F (furnace-butt welded), Grade B, Schedule 40 and Schedule 80, black steel, plain ends.
- B. Malleable-iron threaded fittings: ASME B16.3; Classes 150 and 300.
- C. Malleable-Iron Unions: ASME B16.39; Classes 150, 250, and 300.
- D. Wrought-Steel Fittings: ASTM A 234/A 234M, wall thickness to match adjoining pipe.

- E. Wrought Cast- and Forged-Steel Flanges and Flanged Fittings: ASME B16.5, including bolts, nuts, and gaskets of the following material group, end connections, and facings:
 - 1. Material Group: 1.1.
 - 2. End Connections: Butt welding.
 - 3. Facings: Raised face.
- F. Welding Materials: Comply with Section II, Part C, of the ASME Boiler and Pressure Vessel Code for welding materials appropriate for wall thickness and for chemical analysis of pipe being welded.
- G. Gasket Material: Thickness, material, and type suitable for fluid to be handled; and design temperatures and pressures.

2.4 HYDRONIC SPECIALTIES

- A. Manual Air Vent: Bronze body and nonferrous internal parts; 150-psig (1035-kPa) working pressure; 225 deg F (107 deg C) operating temperature; manually operated with screwdriver or thumbscrew; with NPS 1/8 (DN 6) discharge connection and NPS 1/2 (DN 15) inlet connection.
- B. Automatic Air Vent: Designed to vent automatically with float principle; bronze body and nonferrous internal parts; 150-psig (1035-kPa) working pressure; 240 deg F (116 deg C) operating temperature; with NPS 1/4 (DN 8) discharge connection and NPS 1/2 (DN 15) inlet connection.
- C. Y-Pattern Strainers: 125-psig (860-kPa) working pressure; cast-iron body (ASTM A 126, Class B), flanged ends for NPS 2-1/2 (DN 65) and larger, threaded connections for NPS 2 (DN 50) and smaller, bolted cover, perforated stainless-steel basket, and bottom drain connection.
- D. Flexible Connectors: Stainless-steel bellows with woven, flexible, bronze, wire-reinforcing protective jacket; 150-psig (1035-kPa) minimum working pressure and 250 deg F (121 deg C) maximum operating temperature. Connectors shall have flanged- or threaded-end connections to match equipment connected and shall be capable of 3/4-inch (20-mm) misalignment.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

- A. Refer to Heating and Cooling Pipe Installation Schedule for pipe materials and joints.

See Schedule, next page

HEATING AND COOLING PIPE INSTALLATION SCHEDULE			
Contractor has option where more than one x appears on a line			
Piping System Type	A	B	C
Chilled water	X	X	X
Diesel Engine Cooling Water	X	X	X
Boiler feedwater, blowdown, relief vent	X	X	X

- B. Type A: Schedule 40 black steel, threaded; NPS 2 (DN 50) and smaller with threaded fittings.
- C. Type B: Copper tubing; NPS 2 (DN 50) and smaller pipe sizes with wrought fittings.
- D. Type C: Copper tubing NPS 2.5 (DN 65) and larger pipe sizes with wrought fittings.

3.2 PIPING INSTALLATIONS

- A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping installation requirements.
- B. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.
- C. Install drains, consisting of a tee fitting, NPS 3/4 (DN 20) ball valve, and short NPS 3/4 (DN 20) threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.
- D. Install piping at a uniform grade of 0.2 percent upward in direction of flow.
- E. Reduce pipe sizes using eccentric reducer fitting installed with level side up.
- F. Unless otherwise indicated, install branch connections to mains using tee fittings in main pipe, with the takeoff coming out the bottom of the main pipe. For up-feed risers, install the takeoff coming out the top of the main pipe.

- G. Install strainers on supply side of each control valve, and elsewhere as indicated. Install NPS 3/4 (DN 20) nipple and ball valve in blowdown connection of strainers NPS 2 (DN 50) and larger. Match size of strainer blowoff connection for strainers smaller than NPS 2 (DN 50).
- H. Anchor piping for proper direction of expansion and contraction.
- I. Provide dielectric fittings between steel and copper pipe.

3.3 HANGERS AND SUPPORTS

- A. Hanger, support, and anchor devices are specified in Division 15 Section "Hangers and Supports."
- B. Install the following pipe attachments for hydronic piping:
 - 1. Adjustable steel clevis hangers MSS SP-58 Type 1 for individual horizontal piping.
 - a. Hot systems: Piping lengths less than 20 feet (6 m) long.
 - b. Ambient and cold systems: All piping lengths and pipe sizes.
 - 2. Adjustable roller hangers MSS SP-58 Type 43 and spring hangers for individual horizontal piping. Hot system piping lengths 20 feet (6 m) or longer.
 - 3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping, supported on a trapeze. Hot system piping lengths 20 feet (6 m) or longer.
 - 4. Spring hangers to support vertical runs.
- C. Install hangers for steel piping with the following maximum spacing and minimum rod sizes:
 - 1. NPS 3/4 (DN 20): Maximum span, 7 feet (2.1 m); minimum rod size, 1/4 inch (6.4 mm).
 - 2. NPS 1 (DN 25): Maximum span, 7 feet (2.1 m); minimum rod size, 1/4 inch (6.4 mm).
 - 3. NPS 1-1/2 (DN 40): Maximum span, 9 feet (2.7 m); minimum rod size, 3/8 inch (10 mm).
 - 4. NPS 2 (DN 50): Maximum span, 10 feet (3 m); minimum rod size, 3/8 inch (10 mm).
- D. Install hangers for drawn-temper copper piping with the following maximum spacing and minimum rod sizes:
 - 1. NPS 3/4 (DN 20): Maximum span, 5 feet (1.5 m); minimum rod size, 1/4 inch (6.4 mm).
 - 2. NPS 1 (DN 25): Maximum span, 6 feet (1.8 m); minimum rod size, 1/4 inch (6.4 mm).
 - 3. NPS 1-1/2 (DN 40): Maximum span, 8 feet (2.4 m); minimum rod size, 3/8 inch (10 mm).

4. NPS 2 (DN 50): Maximum span, 8 feet (2.4 m); minimum rod size, 3/8 inch (10 mm).
 5. NPS 2-1/2 (DN 65): Maximum span, 9 feet (2.7 m); minimum rod size, 3/8 inch (10 mm).
- E. Support vertical runs at roof, at each floor, and at 10-foot (3-m) intervals between floors.

3.4 PIPE JOINT CONSTRUCTION

- A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for joint construction requirements for soldered and brazed joints in copper tubing and threaded, welded, and flanged joints in steel piping.

3.5 HYDRONIC SPECIALTIES INSTALLATION

- A. Install manual air vents at high points in piping, at heat-transfer terminal unit coils, and elsewhere as required for system air venting.
- B. Install automatic air vents in mechanical equipment rooms only at high points of system piping, and at air-handling unit heat-transfer coils. Pipe drain to approved location.

3.6 TERMINAL EQUIPMENT CONNECTIONS

- A. Size for supply and return piping connections to equipment shall be as indicated on the drawings.
- B. Install control valves in accessible locations close to connected equipment.
- C. Install ports for pressure and temperature gages at coil inlet connections.

3.7 FIELD QUALITY CONTROL

- A. Prepare hydronic piping according to ASME B31.9 and as follows:
1. Leave joints, including welds, uninsulated and exposed for examination during test.
 2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
 3. Flush system with clean water. Clean strainers.
 4. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.
- B. Perform the following tests on hydronic piping according to ASME B31.9 Hydrostatic Leak Testing, and as follows:

1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
2. While filling system, use vents installed at high points of system to release trapped air. Use drains installed at low points for complete draining of liquid.
3. Check expansion tanks to determine that they are not air bound and that system is full of water.
4. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the design pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed either 90 percent of specified minimum yield strength or 1.7 times "SE" value in Appendix A of ASME B31.9, "Building Services Piping."
5. After hydrostatic test pressure has been applied for at least 60 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.
6. Prepare written report of testing.

3.8 ADJUSTING

- A. Mark calibrated nameplates of pump discharge valves after hydronic system balancing has been completed, to permanently indicate final balanced position.
- B. Perform these adjustments before operating the system:
 1. Open valves to fully open position. Close coil bypass valves.
 2. Check pump for proper direction of rotation.
 3. Set automatic fill valves for required system pressure.
 4. Check air vents at high points of system and determine if all are installed and operating freely (automatic type), or bleed air completely (manual type).
 5. Set temperature controls so all coils are calling for full flow.
 6. Check operation of automatic bypass valves.
 7. Check and set operating temperatures of boilers, chillers, and cooling towers to design requirements.
 8. Lubricate motors and bearings.

3.9 CLEANING

- A. Flush hydronic piping systems with clean water. Remove and clean or replace strainer screens. After cleaning and flushing hydronic piping systems, but before balancing, remove disposable fine-mesh strainers in pump suction diffusers.

END OF SECTION 15181

SECTION 15191 - FUEL OIL PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes diesel fuel piping within the building. Products include the following:
 - 1. Hard-copper tube and wrought-copper fittings.
 - 2. Pipe specialties and valves.
- B. Related Sections include the following:
 - 1. Division 16 Section "Generators" for day tanks provided with engine generators.

1.3 REFERENCED STANDARDS

- A. American Welding Society (AWS):
 - 1. AWS 5.8: Filler Metals for Brazing and Braze Welding
- B. ASME International
 - 1. ASME B16.22: Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
 - 2. ASME B16.24: Cast Copper Alloy Pipe Flanges and Flanged Fittings, Class 150, 300, 400, 600, 900, 1500, and 2500
- C. ASTM International
 - 1. ASTM B 88: Specification for Seamless Copper Water Tube
 - 2. ASTM B 88M: Specification for Seamless Copper Water Tube [Metric]
- D. Manufacturers Standardization Society of The Valve and Fittings Industry Inc.
 - 1. MSS SP-69: Pipe Hangers and Supports - Selection and Application
 - 2. MSS SP-80: Bronze Gate, Globe, Angle, and Check Valves
 - 3. MSS SP-110-96: Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends
- E. NFPA International
 - 1. NFPA 30: Flammable and Combustible Liquids Code
 - 2. NFPA 31: Installation of Oil Burning Equipment
 - 3. NFPA 70: National Electrical Code

F. Underwriters Laboratories Inc.

1. UL 842: Valves for Flammable Fluids

1.4 PERFORMANCE REQUIREMENTS

A. Minimum Working-Pressure Rating: Unless otherwise indicated, minimum pressure requirement for fuel oil piping is 150 psig (1035 kPa).

1.5 SUBMITTALS

A. Product Data: For the following:

1. Pipe, fittings and specialties.
2. Specialty valves.

B. Shop Drawings: Fuel oil piping. Include plans and attachments to other work.

C. Welding certificates.

D. Field quality-control test reports.

1.6 QUALITY ASSURANCE

A. Comply with ASME B31.9, "Building Services Piping," for fuel oil piping materials, installation, testing, and inspecting.

B. Comply with NFPA 30, "Flammable and Combustible Liquids Code," and NFPA 31, "Installation of Oil Burning Equipment," for fuel oil piping materials, components, installations, testing, and inspecting.

1.7 COORDINATION

A. Coordinate location of piping and supports with generator, day tank, and other equipment specified in Division 16.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Hard Copper Tube: ASTM B 88, Type L (ASTM B 88M, Type B), drawn temper.

1. Copper Fittings: ASME B16.22, wrought copper, streamlined pattern.
2. Brazing Filler Metals: AWS A5.8, Silver Classification BAg-1. Filler metal containing phosphorus is prohibited.
3. Bronze Flanges and Flanged Fittings: ASME B16.24, Class 150.
4. Gasket Material: Thickness, material, and type suitable for fuel oil.

B. Transition Fittings: Type, material, and end connections to match piping being joined.

- C. Pipe Connectors: UL 567, swivel or compression type for connection to equipment.

2.2 SPECIALTY VALVES

- A. Ball Valves: UL 842; carbon steel body ball valve with chrome-plated ball and threaded ends according to ASME B1.20.1 for pipe threads, suitable for flammable liquid shutoff.
- B. Check Valves, NPS 2 (DN 50) and Smaller: MSS SP-80, Type 3 Class 125, bronze body, valves suitable for fuel oil service, with "WOG" indicated on body.
 - 1. Swing check valves shall have bronze disc.
 - 2. Lift check valves shall be vertical pattern; two-piece construction with bronze disc.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in for fuel oil piping system to verify actual locations of piping connections before equipment installation.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PIPING INSTALLATION

- A. General piping installation requirements are specified in Division 15 Section "Basic Mechanical Materials and Methods."
- B. Identify fuel oil piping and equipment as specified in Division 15 Section "Mechanical Identification."
- C. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.

3.3 JOINT CONSTRUCTION

- A. Joining Materials: Brazing materials are specified in Division 15 Section "Basic Mechanical Materials and Methods."
- B. Pipe joint construction is specified in Division 15 Section "Basic Mechanical Materials and Methods."

3.4 VALVE INSTALLATION

- A. Install valves in accessible locations, protected from damage.
- B. Install ball valves at branch connections to supply mains and at equipment.
- C. Identify valves as specified in Division 15 Section "Mechanical Identification."

3.5 HANGER AND SUPPORT INSTALLATION

- A. Pipe hangers and supports and equipment supports materials and installation requirements are specified in Division 15 Section "Hangers and Supports."
- B. Support vertical steel pipe at each floor and at spacing not greater than 15 feet (4.5 m).
- C. Install hangers for horizontal drawn-temper copper tubing with the following maximum spacing and minimum rod sizes:
 - 1. NPS 1/2 (DN 15) and Smaller: Maximum span, 48 inches (1219 mm); minimum rod size, 3/8 inch (10 mm).
 - 2. NPS 3/4 (DN 20): Maximum span, 60 inches (1524 mm); minimum rod size, 3/8 inch (10 mm).
 - 3. NPS 1 and NPS 1-1/4 (DN 25 and DN 32): Maximum span, 72 inches (1828 mm); minimum rod size, 3/8 inch (10 mm).
 - 4. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): Maximum span, 96 inches (2438 mm); minimum rod size, 3/8 inch (10 mm).

3.6 CONNECTIONS

- A. Install piping adjacent to equipment to allow service and maintenance.
- B. Connect piping to equipment with fuel oil ball valve and union. Install union between valve and equipment.
- C. Provide gasketed flanges at connections of new piping to existing fuel oil piping to facilitate testing, service, and maintenance.

3.7 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
 - 1. Inspect and test fuel oil piping according to NFPA 31, "Tests of Piping" Paragraph; and according to requirements of authorities having jurisdiction.
 - 2. Isolate new piping from existing fuel oil piping installation during leak tests.
 - 3. Hydro pressure test new fuel oil piping at 150 percent of minimum working pressure for minimum duration of 15 minutes.
 - 4. Start fuel oil transfer pumps on day tank to verify for proper operation of pump and check for leaks.
 - 5. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- B. Repair leaks and defects with new materials and retest system until satisfactory results are obtained.

END OF SECTION 15191

SECTION 15229 - DIESEL EXHAUST PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes diesel-engine generator exhaust piping and accessories.
- B. Related Sections include:
 - 1. Division 15 Section "Basic Mechanical Materials and Methods."
 - 2. Division 15 Section "Hangers and Supports."
 - 3. Division 15 Section "Mechanical Vibration Controls."
 - 4. Division 15 Section "Pipe Insulation."
 - 5. Division 16 Section "Generators" for generator exhaust connections, silencer, and exhaust accessories furnished by generator manufacturer.

1.3 REFERENCES

- A. National Fire Protection Association (NFPA):
 - 1. NFPA 37: Stationary Combustion Engines and Gas Turbines.
 - 2. NFPA 110: Emergency and Standby Power Systems.

1.4 SUBMITTALS

- A. Shop Drawings:
 - 1. Show fabrication and installation details for generator exhaust piping including engine connections, silencer, wall thimble, piping, and rain cap.
 - 2. Prepare coordination drawings as specified in the Article "Submittals" in Division 1 Section "General Requirements," including the generator exhaust piping installation.
- B. Product data:
 - 1. Pipe and fittings.
 - 2. Flanges and gaskets.
 - 3. Wall thimble.
- C. Certifications: Welding certificates.

- D. Field quality control test reports: Air leakage report showing successful pressurized-air test of exhaust piping installation.

1.5 QUALITY ASSURANCE

- A. Perform welding in accordance with requirements specified in Division 15 Section “Basic Mechanical Materials and Methods.”
- B. Installed system shall meet the requirements of NFPA 37 and NFPA 110.

1.6 COORDINATION

- B. Coordinate location of exhaust piping, silencer, and exhaust accessories with generator provided as specified in Division 16 Section “Generators.”

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Exhaust Pipe: Black steel and galvanized steel, ASTM A 53/A 53M, Type S seamless, Grade B, Standard Weight.

2.2 PRODUCTS

- A. Welding Fittings: ASTM A 234/A 234M, Wrought steel.
- B. Flanges: ASME B16.5, Class 150, raised face, butt weld, black and galvanized steel, with corrosion-resistant fasteners.
- C. Gaskets: Spiral-wound, suitable for raised-face flanges and high-temperature, gastight duty.
- D. Exhaust Thimbles: Fabricate from 12-gage ASTM A 167 Type 304 stainless steel as detailed on the drawings.
- E. Exhaust Rain Caps: Factory-fabricated from 12-gage ASTM A 167 Type 304 stainless steel, with 25-mm (1-inch) downturned lip, sized to suit outside diameter of exhaust pipe outlet.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Piping: Install as detailed on the drawings and in accordance with installation and testing requirements of Division 15 Section “Basic Mechanical Materials and Methods.”
 - 1. Provide galvanized steel piping from generator-mounted flexible connections to the muffler inlet, and from the muffler outlet to the exhaust termination point.

2. Install gasketed flanged connections to engine connection assemblies and to silencer.
 3. Install long-radius, 90-degree elbows on exhaust pipe bends. Mitered bends are not permitted.
- B. Coordinate with installation of generator. Install appurtenances and devices required to complete installation of exhaust piping, arranged to allow service and maintenance as indicated on approved shop drawings.
- C. Install flexible connectors, wye connection assemblies, and silencers provided by the generator manufacturer in accordance with the manufacturer's recommendation.
- D. Thimble: Install in wall as detailed on the drawings.
- E. Install rain cap to fully open when generator is energized and close when generator is deenergized.

3.2 HANGER AND SUPPORT INSTALLATION

- A. Pipe hangers and supports, vibration isolators, and equipment supports, and their installation, are specified in Division 15 Sections "Hangers and Supports" and "Mechanical Vibration Controls."

3.3 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
1. Inspect and test generator exhaust piping. Verify that system meets requirements of NFPA 37 and NFPA 110.
 2. Air-pressure test exhaust piping installation, from engine connections to exhaust discharge with silencer but before rain cap is installed, to 350 kPa (50 psig) for no less than 15 minutes.
 - a. Repair leaks and defects with new materials and retest system until no leaks are found.

END OF SECTION 15229

SECTION 15430 - PLUMBING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following plumbing specialties:

1. Backflow preventers.
2. Strainers.
3. Trap seal primer valves.
4. Drain valves.
5. Miscellaneous piping specialties.
6. Cleanouts.
7. Floor drains.

- B. Related Sections include the following:

1. Division 15 Section "Meters and Gages" for thermometers and pressure gages.
2. Division 15 "Basic Mechanical Materials and Methods" for piping joining materials and joint construction.
3. Division 15 Section "Pipe Insulation" for specialty requirements for insulation.
4. Division 15 "Valves" for general-duty valves.
5. Division 15 "Sanitary Waste and Vent Piping" for sanitary soil, waste, and vent requirements for plumbing specialties.
6. Division 15 "Domestic Water Piping" for water supplies to plumbing specialties.

1.3 REFERENCED STANDARDS

- A. American Society for Testing and Materials

1. ASTM A 74: Specification for Cast Iron Soil Pipe and Fittings
2. ASTM A 666: Specification for Annealed or Cold-Worked Austenitic Stainless Steel, Sheet, Strip, Plate, and Flat Bar.
3. ASTM B 32: Specification for Solder Metal.
4. ASTM B 88: Specification for Seamless Copper Water Tube.
5. ASTM B 88M: Specification for Seamless Copper Water Tube [Metric].
6. ASTM B 152: Specification for Copper Sheet, Strip, Plate, and Rolled Bar.
7. ASTM B 152M: Specification for Copper Sheet, Strip, Plate, and Rolled Bar [Metric].
8. ASTM B 749: Specification for Lead and Lead Alloy Strip, Sheet, and Plate Products.
9. ASTM C 564: Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.

B. ASME International

1. ASME A112.1.2: Air Gaps in Plumbing Systems
2. ASME A112.21.1M: Floor Drains
3. ASME A112.21.2M: Roof Drains
4. ASME A112.36.2M: Cleanouts
5. ASME B1.20.7: Hose Coupling Screw Threads (Inch)
6. ASME B31.9: Building Services Piping

C. American Society of Sanitary Engineering

1. ASSE 1001: Pipe Applied Atmospheric Type Vacuum Breakers
2. ASSE 1003: Water Pressure Reducing Valves
3. ASSE 1011: Hose Connection Vacuum Breakers
4. ASSE 1013: Reduced Pressure Principle Backflow Preventers
5. ASSE 1018: Trap Seal Primer Valves - Water Supply Fed
6. ASSE 1019: Vacuum Breaker Wall Hydrants, Freeze Resistant Automatic Draining Type
7. ASSE 1044: Trap Seal Primer Valves - Drainage Type
8. ASSE 1047: Reduced Pressure Detector Backflow Preventers
9. ASSE 1048: Double Check Detector Assembly Backflow Preventers
10. ASSE 1052: Hose Connection Backflow Preventers

D. American Water Works Association

1. AWWA C550: Protection Epoxy Interior Coatings for Valves and Hydrants

E. Manufacturers Standardization Society of the Valve and Fittings Industry

1. MSS SP-110: Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends

F. NSF International

1. NSF 61: Drinking Water System Components - Health Effects; Section 1 through 9.

G. The Society for Protective Coatings

1. SSPC-Paint 12: Paint Specification No. 12: Cold-Applied Asphalt Mastic (Extra Thick Film)

1.4 DEFINITIONS

A. Grate testing ratings for drains:

1. Light duty: Loads less than 2000 lb (907 kg).
2. Medium duty: Loads from 2000 to 4999 lb (907 to 2267 kg).

3. Heavy duty: Loads from 5000 to 7499 lb (2268 to 3401 kg).
4. Extra heavy duty: Loads from 7500 to 10,000 lb (3401 to 4536 kg).
5. Special duty: Loads more than 10,000 lb (4536 kg).

1.5 PERFORMANCE REQUIREMENTS

- A. Provide components and installation capable of producing piping systems with following minimum working-pressure ratings, unless otherwise indicated:
 1. Domestic Water Piping: 125 psig (860 kPa).
 2. Sanitary Waste and Vent Piping: 10-foot head of water (30 kPa).

1.6 SUBMITTALS

- A. Product Data: Include rated capacities and shipping, installed, and operating weights. Indicate materials, finishes, dimensions, required clearances, and methods of assembly of components; and piping and wiring connections for the following:
 1. Backflow preventers.
 2. Balancing valves and strainers.
 3. Drain valves.
 4. Cleanouts, floor drains, open receptors and roof drains.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Field test reports.
- D. Maintenance Data: For plumbing specialties to include in maintenance manuals. Include the following:
 1. Backflow preventers.
 2. Trap seal primer valves and systems.

1.7 QUALITY ASSURANCE

- A. Plumbing specialties shall bear label, stamp, or other markings of specified testing agency.
- B. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for piping materials and installation.
- C. NSF Compliance: Comply with NSF 61, "Drinking Water System Components--Health Effects, Sections 1 through 9," for potable domestic water plumbing specialties.

PART 2 - PRODUCTS

2.1 BACKFLOW PREVENTERS

- A. General: ASSE standard, backflow preventers.

1. NPS 2 (DN 50) and Smaller: Bronze body with threaded ends.
 2. Interior Components: Corrosion-resistant materials.
 3. Strainer: On inlet, if indicated or specified below.
- B. Reduced-Pressure-Principle Backflow Preventers: ASSE 1013 and AWWA compliant C511 suitable for continuous pressure application. Include outside screw and yoke gate valves on inlet and outlet, and strainer on inlet; test cocks; and pressure-differential relief valve with ASME A112.1.2 air-gap fitting located between two positive-seating check valves.
1. Pressure Loss: 15 psig (104 kPa) maximum, through middle 1/3 of flow range.
- C. Hose-Connection Backflow Preventers: ASSE 1052, suitable for at least 3-gpm (0.19-L/s) flow and applications with up to 10-foot head of water (30-kPa) back pressure. Include two check valves; intermediate atmospheric vent; and nonremovable, ASME B1.20.7, garden-hose threads on outlet.

2.2 BALANCING VALVES

- A. Calibrated Balancing Valves: Adjustable, with two readout ports and memory setting indicator. Include manufacturer's standard hoses, fittings, valves, differential pressure meter, and carrying case.
1. NPS 2 (DN 50) and Smaller: Bronze body with brass ball, adjustment knob, calibrated nameplate, and threaded or solder-joint ends.
 2. NPS 2 (DN 50) and Smaller: Bronze, Y-pattern body with adjustment knob and threaded ends.

2.3 STRAINERS

- A. Strainers: Y-pattern, unless otherwise indicated, and full size of connecting piping. Include ASTM A 666, Type 304, stainless-steel screens with 3/64-inch (1.2-mm) round perforations, unless otherwise indicated.
1. Pressure Rating: 125-psig (860-kPa) minimum steam working pressure, unless otherwise indicated.
 2. NPS 2 (DN 50) and Smaller: Bronze body, with female threaded ends.
 3. NPS 2-1/2 (DN 65) and Larger: Cast-iron body, with interior AWWA C550 or FDA-approved, epoxy coating and flanged ends.
 4. Y-Pattern Strainers: Screwed screen retainer with centered blowdown.
- B. Drain: Factory- or field-installed, hose-end drain valve.

2.4 TRAP SEAL PRIMER VALVES

- A. Supply-Type Trap Seal Primer Valves: ASSE 1018, water-supply-fed type, with the following characteristics:
1. 125-psig (860-kPa) minimum working pressure.

2. Bronze body with atmospheric-vented drain chamber.
 3. Inlet and Outlet Connections: NPS 1/2 (DN 15) threaded, union, or solder joint.
 4. Gravity Drain Outlet Connection: NPS 1/2 (DN 15) threaded or solder joint.
 5. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.
- B. Drainage-Type Trap Seal Primer Valves: ASSE 1044, fixture-trap, waste-drainage-fed type, with the following characteristics:
1. Chrome-plated, cast-brass, NPS 1-1/4 (DN 32) minimum, lavatory P-trap with NPS 3/8 (DN 10) minimum, trap makeup connection.

2.5 MISCELLANEOUS PIPING SPECIALTIES

- A. Hose Bibbs: Bronze body with replaceable seat disc complying with ASME A112.18.1M for compression-type faucets. Include NPS 1/2 or NPS 3/4 (DN 15 or DN 20) threaded or solder-joint inlet, of design suitable for pressure of at least 125 psig (860 kPa); integral [or field-installed,] nonremovable, drainable hose-connection vacuum breaker; and garden-hose threads complying with ASME B1.20.7 on outlet.
1. Finish for Equipment Rooms: Rough bronze, or chrome or nickel plated.
 2. Finish for Service Areas: Rough bronze.
 3. Operation for Equipment Rooms: Wheel handle or operating key.
 4. Operation for Service Areas: Wheel handle.
- B. Air Vents: Float type for automatic air venting.
1. Welded Construction: Stainless-steel body with corrosion-resistant metal float, stainless-steel mechanism and seat, threaded NPS 3/8 (DN 10) minimum inlet, 150-psig (1035-kPa) minimum pressure rating, and threaded vent outlet.
- C. Deep-Seal Traps: Cast-iron or bronze casting, with inlet and outlet matching connected piping and cleanout trap seal primer valve connection.
1. NPS 2 (DN 50): 4-inch- (100-mm-) minimum water seal.
 2. NPS 2-1/2 (DN 65) and Larger: 5-inch- (125-mm-) minimum water seal.
- D. Floor-Drain Inlet Fittings: Cast-iron, with threaded inlet and threaded or spigot outlet, and trap seal primer valve connection.

2.6 CLEANOUTS

- A. Cleanouts, types, material; installation location are indicated on the cleanout schedule at the end of this section. Cleanouts shall comply with ANSI A112.36.2M.

2.7 FLOOR DRAINS

- A. Floor Drains, types, material, installation location are indicated on the Floor Drain Schedule at the end of this section. Comply with ASME A112.21.1M.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for piping joining materials, joint construction, and basic installation requirements.
- B. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.
 - 1. Locate backflow preventers in same room as connected equipment or system.
 - 2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe to floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are not acceptable for this application.
 - 3. Do not install bypass piping around backflow preventers.
- C. Install strainers on supply side of each control valve, pressure regulator, and solenoid valve.
- D. Install trap seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.
- E. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
 - 1. Size same as drainage piping up to NPS 4 (DN 100). Use NPS 4 (DN 100) for larger drainage piping unless larger cleanout is indicated.
 - 2. Locate at each change in direction of piping greater than 45 degrees.
 - 3. Locate at minimum intervals of 50 feet (15 m) for piping NPS 4 (DN 100) and smaller and 100 feet (30 m) for larger piping.
 - 4. Locate at base of each vertical soil and waste stack.
- F. Install cleanout deck plates with top flush with finished floor, for floor cleanouts for piping below floors.
- G. Install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall, for cleanouts located in concealed piping.
- H. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.
 - 1. Position floor drains for easy access and maintenance.

2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:
 - a. Radius, 30 Inches (750 mm) or Less: Equivalent to 1 percent slope, but not less than 1/4-inch (6.35-mm) total depression.
 - b. Radius, 30 to 60 Inches (750 to 1500 mm): Equivalent to 1 percent slope.
 - c. Radius, 60 Inches (1500 mm) or Larger: Equivalent to 1 percent slope, but not greater than 1-inch (25-mm) total depression.
3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.
- C. Connect plumbing specialties to piping specified in other Division 15 Sections.

3.3 LABELING AND IDENTIFYING

- A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each backflow preventer.
 1. Text: Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit.
 2. Refer to Division 15 Section "Mechanical Identification" for nameplates and signs.

3.4 SCHEDULES

(See following page for Schedules)

CLEANOUT SCHEDULE					
Application	Finished Building Surface	Top Style	Top Finish	Body Material	Closure
Floor	Exposed Areas with Concrete Floors	Round, Scoriated, Secured Top	Nickel Bronze	Cast Iron	Bronze Plug-Tapered

GENERAL NOTES:

- A. All tops shall be heavy-duty top loading classification
- B. Provide clamping device on cleanouts installed in floor slabs above grade.
- C. Outlet connection shall be compatible with material of connected piping.

FLOOR DRAIN SCHEDULE					
Designation	Type	Strainer Type and Size	Finish	Accessories	Notes
FD-1	Floor/Funnel Drain	7-inch (175 mm) Diameter Type "E" Strainer with 4-inch (100 mm) Funnel	Nickel Bronze Top	--	1

NOTES

- 1. Miscellaneous Equipment Drain.

General Notes:

- A. All tops shall be heavy-duty top loading classification
- B. Provide seepage flange on floor drains installed in floor slabs above grade
- C. Outlet connection shall be compatible with material of connected piping

END OF SECTION 15430

SECTION 15763 - FAN-COIL UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes fan-coil units and accessories.
- B. Related Sections:
 - 1. Division 15 Section "Hangers and Supports" for equipment supports.
 - 2. Division 15 Section "Hydronic Piping" for pipe connections and specialties.
 - 3. Division 15 Section "Mechanical Vibration Controls" for vibration isolators.
 - 4. Division 15 Section "Air Filters" for fan-coil unit filters.
 - 5. Division 15 Section "HVAC Instrumentation and Controls" for control valves, sensors, and connections.

1.3 REFERENCED STANDARDS

- A. American Refrigeration Institute
 - 1. ARI 350: Sound Rating of Non-Ducted Indoor Air-Conditioning Equipment
 - 2. ARI 440: Room Fan-Coil and Unit Ventilators
- B. American Society for Testing and Materials
 - 1. ASTM C 916: Specification for Adhesives for Duct Thermal Insulation
 - 2. ASTM C 1071: Specification for Thermal and Acoustical Insulation (Glass Fiber, Duct Lining Material)
 - 3. ASTM E 84: Test Method for Surface Burning Characteristics of Building Materials
- C. American Society of Heating, Refrigerating and Air-Conditioning Engineers
 - 1. ASHRAE 33: Methods of Testing Forced Circulation Air Cooling and Heating Coils
 - 2. ASHRAE 90.1: Energy Standard for Buildings Except Low-Rise Residential Buildings
- D. National Fire Protection Association
 - 1. NFPA 70: National Electrical Code
 - 2. NFPA 90A: Installation of Air Conditioning and Ventilating Systems
 - 3. NFPA 90B: Warm Air Heating and Air Conditioning Systems

- E. Underwriters Laboratories Inc.
 - 1. UL 486A: Wire Connectors and Soldering Lugs for Use with Copper Conductors
 - 2. UL 486B: Wire Connectors for Use with Aluminum Conductors

1.4 SUBMITTALS

- A. Product Data: Include specialties and accessories for each unit type and configuration.
 - 1. Submit product data which verifies compliance with ASHRAE 90.1, or provide certified performance ratings by a qualified independent testing agency.
- B. Shop Drawings: Submit the following for each fan-coil unit type and configuration:
 - 1. Plans, elevations, sections, and details.
 - 2. Details of anchorages and attachments to structure and to supported equipment.
 - 3. Power, signal, and control wiring diagrams. Differentiate between manufacturer-installed and field-installed wiring.
 - 4. Equipment schedules to include rated capacities; shipping, installed, and operating weights; furnished specialties; and accessories.
 - 5. Unit shown on drawings is based on the dimensions scheduled on the drawings. If another acceptable unit should be proposed, ascertain that it will fit in the available space. Include, with shop drawings of the unit, scale drawings similar to the contract drawings, including plans, elevations, sections, and diagrams, showing any changes in wiring, arrangement, or access necessary to accommodate the proposed unit.
 - 6. Shop drawings shall show complete dimensions of complete assembled unit with accessories.
- C. Coordination Drawings: Prepare coordination drawings in accordance with requirements specified in Division 1. Include the following:
 - 1. Adjacent ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, and raceways.
- D. Samples: Manufacturer's color charts showing the full range of colors available for units with factory-applied color finishes.
- E. Field Test Reports: Written reports of tests specified in Part 3 of this Section.
- F. Maintenance Data: For fan-coil units to include in maintenance manuals specified in Division 1. Include the following:
 - 1. Maintenance schedules and repair parts lists for motors, coils, integral controls, and filters.

1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Unit capacity shall be certified in compliance with ARI 440.
- C. Unit shall be tested and sound rated in accordance with ARI 350.
- D. HVAC equipment shall meet the energy performance requirements of ASHRAE 90.1.

1.6 COORDINATION

- A. Coordinate layout and installation of horizontal fan-coil units and suspension system components with other construction.

PART 2 - PRODUCTS

2.1 FAN-COIL UNITS BASIC REQUIREMENTS

- A. Units shall be type, size, configuration, capacity and current characteristics indicated on the drawings.
- B. Provide each unit with factory-installed means of disconnect in compliance with NFPA 70 (NEC) and applicable local codes. In the event a factory installed disconnect is not available, provide an approved means of disconnect for field mounting.

2.2 CONFIGURATION

- A. Horizontal Units: An assembly including cabinet, filter, chassis, coil, drain pan, fan and motor in blow-through configuration with hydronic cooling coil, suitable for high static pressure, ducted installation.

2.3 CHASSIS AND CABINET

- A. Chassis: Galvanized steel, with flanged edges.
- B. Coil Section Insulation: 1-inch (25-mm) duct liner complying with ASTM C 1071 and attached with adhesive complying with ASTM C 916.
 - 1. Fire-Hazard Classification: Duct liner and adhesive shall have a maximum flame-spread rating of 25 and smoke-developed rating of 50 when tested according to ASTM E 84.
- C. Drain Pans: ASTM A 167 Type 304 stainless steel, with connection for drain. Drain pan shall have a removable plastic liner or be constructed of noncorroding material and be insulated with polystyrene or polyurethane insulation. Drain pan shall be formed to slope 0.25 inch per foot (20 mm per meter) minimum in two directions to NPS 0.75 (DN 20) drain connection.

- D. Cabinet: 16-gauge (1.6-mm-thick) galvanized steel, with removable panels. Provide duct collars for supply air duct connection and return air duct connection.
- E. Cabinet Finish: Bonderize, phosphatize, and flow-coat with baked-on primer with manufacturer's standard paint, in color selected by Architect, applied to factory-assembled and -tested fan-coil unit before shipping.

2.4 WATER COILS

- A. Cooling Coil: 0.5 inch (15 mm) diameter copper tube, with mechanically bonded copper fins spaced no closer than 0.1 inch (2.5 mm) and with manual air vent. Coils shall be rated for a minimum working pressure of 250 psig (1725 kPa) and a maximum entering water temperature of 200 deg F (93 deg C).

2.8 FAN

- A. Centrifugal, with forward-curved, double-width wheels and fan scrolls made of galvanized steel or thermoplastic material; directly connected to motor.
- B. Housing: Galvanized steel, two-piece construction with removable front half for complete access to fans.

2.9 FAN MOTORS

- A. Comply with requirements of Division 15 Section "Motors."
- B. Wiring Terminations: Connect motor to chassis wiring with plug connection.

2.10 ACCESSORIES

- A. Integral return-air grille, single-deflection bar type, hinged with 1-inch (25 mm)-thick throwaway filter. Finish shall match cabinet.
- B. Filters: 1-inch- (25-mm-) thick, throwaway filters in fiberboard frames. Specified in Division 15 Section "Air Filters."
- C. Speed controller: Unit-mounted, three-speed fan motor controller.

2.12 CONTROL SYSTEMS

- A. Specified in Division 15 Section "HVAC Instrumentation and Controls."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas to receive fan-coil units for compliance with requirements for installation tolerances and other conditions affecting performance.

- B. Examine roughing-in for piping and electrical connections to verify actual locations before fan-coil unit installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install fan-coil units level and plumb to assure proper drainage and operation.
- B. Install fan-coil units to comply with NFPA 90A.
- C. Suspend fan-coil units from structure with rubber-in-shear vibration isolators (rubber hangers). Vibration isolators are specified in Division 15 Section "Mechanical Vibration Controls."
- D. Install wall-mounting thermostats and switch controls in electrical outlet boxes at heights to match lighting controls.
- E. Install unit in accordance with the drawings and the manufacturer's instructions.
- F. Provide dielectric pipe fittings at water-coil connections where dissimilar metals are joined.
- G. Provide wiring for remote thermostat and speed switch.
- H. Install throw-away filter provided with unit prior to energizing the unit supply fan.
- I. Prior to air balancing, remove throwaway filter and install new filter as specified in Division 15 Section "Filters."
- J. Coordinate with air balancing to provide the proper drive and belts or adjust fan speed to obtain the air flow and static pressure indicated on the drawings.

3.3 CONNECTIONS

- A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Unless otherwise indicated, install shutoff valve and union or flange at each connection.
- C. Install piping adjacent to machine to allow service and maintenance.
- D. Ground equipment.
- E. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values.

3.4 FIELD QUALITY CONTROL

- A. Testing: Perform the following field quality-control testing and report results in writing:
 - 1. After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - 2. Test and adjust controls and safeties.
- B. Repair or replace malfunctioning units. Retest as specified above after repairs or replacements are made.

3.5 CLEANING

- A. After installing units, inspect unit cabinet for damage to finish. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.
- B. After installing units, clean fan-coil units internally according to manufacturer's written instructions.

3.6 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Government's maintenance personnel to adjust, operate, and maintain fan-coil units.
 - 1. Train Government's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining equipment.
 - 2. Review data in maintenance manuals. Refer to Division 1 Section "General Requirements."
 - 3. Schedule training with Government, through Architect, with at least seven days advance notice.
 - 4. As specified in Division 15 Section "Basic Mechanical Materials and Methods," provide operating instructions.
 - 5. Provide at least 2 hours of additional instruction time for the equipment specified in this section.

END OF SECTION 15763

SECTION 15815 - METAL DUCTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes metal ducts for supply, return, outdoor, and exhaust air-distribution systems in pressure classes from minus 2- to plus 10-inch wg (minus 500 to plus 2500 Pa). Metal ducts include the following:
 - 1. Rectangular ducts and fittings.
- B. Related Sections include the following:
 - 1. Division 15 Section "Basic Mechanical Materials and Methods" for general construction materials and methods required for installing metal ducts.
 - 2. Division 15 "Mechanical Vibration Controls" for hangers and supports for ducts directly attached to isolated equipment.
 - 3. Section 15 "Mechanical Identification" for labeling and identifying ducts if requirements in Section 15050 are not sufficient.
 - 4. Division 15 Section "Duct Insulation".
 - 5. Division 15 Section "Duct Accessories" for volume-control dampers and devices, fire-and smoke-control dampers, duct-mounting access panels, flexible ducts and connectors, sound-control devices, and other accessories.
 - 6. Division 15 Section "Diffusers, Registers, and Grilles."
 - 7. Division 15 Section "Testing, Adjusting, and Balancing" for testing, adjusting, and balancing of air-handling systems.

1.3 REFERENCED STANDARDS

- A. ASTM International
 - 1. ASTM A 36/A 36M: Specification for Carbon Structural Steel
 - 2. ASTM A 366/A 366M: Specification for Steel, Sheet, Carbon, Cold-Rolled, Commercial Quality
 - 3. ASTM A 480A/A 480M: Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip
 - 4. ASTM A 653/A 653M: Specifications for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
 - 5. ASTM B 209: Specification for Aluminum and Aluminum-Alloy Sheet and Plate
 - 6. ASTM B 209M: Specification for Aluminum and Aluminum-Alloy Sheet and Plate [Metric]

7. ASTM C 411: Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation
 8. ASTM C 534: Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form
 9. ASTM C 916: Specification for Adhesives for Duct Thermal Insulation
 10. ASTM C 920: Specification for Elastomeric Joint Sealants.
 11. ASTM C 1071: Specification for Thermal and Acoustical Insulation (Glass Fiber, Duct Lining Material)
 12. ASTM E 84: Test Method for Surface Burning Characteristics of Building Materials
 13. ASTM G 21: Determining Resistance of Synthetic Polymeric Materials to Fungi.
 14. ASTM G 22: Determining Resistance of Synthetic Polymeric Materials to Bacteria.
- B. American Welding Society
1. AWS D1.1 - Structural Welding Code—Steel
 2. AWS D1.2 - Structural Welding Code—Aluminum
 3. AWS D9.1-Sheet Metal Welding Code
- C. National Air Duct Cleaners Association (1518 K St., NW, Suite 503, Washington, DC 20005; 202-737-2926; www.nadca.com).
1. NADCA 1992: Mechanical Cleaning of Non-Porous Air Conveyance System Components
- D. National Fire Protection Association
1. NFPA 90A: Installation of Air Conditioning and Ventilating Systems (ANSI)
 2. NFPA 90B: Installation of Warm Air Heating and Air Conditioning Systems (ANSI)
 3. NFPA 96: Ventilation Control and Fire Protection of Commercial Cooking Operations (ANSI)
- E. The North American Insulation Manufacturers Association
1. NAIMA AH124: Fibrous Glass Duct Liner Standard
- F. Sheet Metal and Air Conditioning Contractor's National Association
1. Duct Cleanliness for New Construction.
 2. HVAC Air Duct Leakage Test Manual.
 3. HVAC Duct Construction Standards—Metal and Flexible.
- G. Underwriters Laboratories Inc.
1. UL 181: Factory-Made Air Ducts and Air Connectors
 2. UL 723: Test for Surface Burning Characteristics of Building Materials

1.4 SYSTEM DESCRIPTION

- A. Duct system design, as indicated, has been used to select size and type of air-moving and -distribution equipment and other air system components. Changes to layout or configuration of duct system must be specifically approved in writing by Architect. Accompany requests for layout modifications with calculations showing that proposed layout will provide original design results without increasing system total pressure.

1.5 PERFORMANCE REQUIREMENTS

A. Duct Construction:

1. For systems not indicated in the Duct Construction Schedule, the duct construction pressure class shall be determined as follows:

Fan External Static Pressure (Positive or Negative)	SMACNA Duct Construction Pressure Class (Positive or Negative)
Up to 1.4 inches	2.0 inch (50 Pa)
1.41 to 2.0 inches	3.0 inch (75 Pa)

- B. Duct Air Leakage: Duct air leakage shall not exceed the leakage factor associated with the duct pressure class and test pressure, as indicated in the following table.

Duct Pressure Class (inches w.c.)	Leakage Class	Test Pressure (inches w.c.)	Leakage Factor
2.0 (50 Pa)	6	2.0 (50 Pa)	10
3.0 (75 Pa)	6	3.0 (75 Pa)	13

Note: Leakage factor is CFM/100 sq. ft. of duct surface area.

1.6 SUBMITTALS

- A. Shop Drawings: CAD-generated and drawn to 1/4 inch equals 1 foot (1:50) scale. Show fabrication and installation details for metal ducts.
1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
 2. Duct layout indicating sizes and pressure classes.
 3. Elevations of top and bottom of ducts.
 4. Fittings.
 5. Seam and joint construction.
 6. Penetrations through fire-rated and other partitions.
 7. Equipment installation based on equipment being used on Project.
 8. Duct accessories, including access doors and dampers.

9. Hangers and supports, including methods for duct and building attachment, vibration isolation.
 10. Air device installation based on air devices being used on project.
- B. Coordination Drawings: Prepare coordination drawings in accordance with requirements specified in Division 1. Include the following:
1. Other systems installed in same space as ducts.
 2. Ceiling-mounting items, including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and raceways.
- C. Field quality-control test reports.
1. Air Duct Leakage Test Summary: Submit data on forms as indicated in the SMACNA HVAC Duct Leakage Test Manual. (See sample form at end of section.)

1.7 QUALITY ASSURANCE

- A. Specified and scheduled duct construction exceeds SMACNA requirements. Comply with specifications and schedules, and for materials or methods not specified or scheduled, comply with SMACNA "HVAC Duct Construction Standards–Metal and Flexible."
- B. Welding: Refer to Division 15 Section "Basic Mechanical Materials and Methods" for welding requirements.
- C. NFPA Compliance:
1. NFPA 90A, "Installation of Air Conditioning and Ventilating Systems."
 2. NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

PART 2 - PRODUCTS

2.1 SHEET METAL MATERIALS

- A. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for acceptable materials, unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Lock-forming quality; complying with ASTM A 653/A 653M and having G90 (Z275) coating designation; ducts shall have mill-phosphatized finish for surfaces exposed to view.
- C. Aluminum Sheets: ASTM B 209 (ASTM B 209M), alloy 3003, temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.
- D. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts, aluminum on aluminum ducts.

- E. Tie Rods: Galvanized steel, 1/4-inch (6-mm) minimum diameter for lengths 36 inches (900 mm) or less; 3/8-inch (10-mm) minimum diameter for lengths longer than 36 inches (900 mm).

2.2 SEALANT MATERIALS

- A. Water-Based Joint and Seam Sealant: Indoor/outdoor, flexible, adhesive sealant, high-pressure type (up to 10 inches (2490 Pa) SMACNA pressure class), resistant to UV light when cured, UL 723 listed, and complying with NFPA requirements, brush-on application.
- B. Pressure-sensitive sealant: Two-mil (0.05-mm) aluminum foil backing, peel-off release liner, 33-mil (0.8-mm) modified elastomeric butyl sealant (100 percent solids). Outdoor use only.
- C. Silicone sealant: Clear, ASTM 920, Type S, Grade NS, Class 25, single-component, UV-resistant, indoor or outdoor application.
- D. Solvent-Based Joint and Seam Sealant: One-part, nonsag, solvent-release-curing, polymerized butyl sealant formulated with a minimum of 75 percent solids.
- E. Flanged Joint Mastic: One-part, acid-curing, silicone, elastomeric joint sealant complying with ASTM C 920, Type S, Grade NS, Class 25, Use O.
- F. Flange Gaskets: Butyl rubber or EPDM polymer with polyisobutylene plasticizer.

2.3 HANGERS AND SUPPORTS

- A. Building Attachments: Refer to Division 15 Section "Hangers and Supports".
- B. Hanger Materials: Galvanized sheet steel or threaded steel rod.
 - 1. Hangers Installed in Corrosive Atmospheres: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
 - 2. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for steel sheet width and thickness and for steel rod diameters.
- C. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- D. Trapeze and Riser Supports: Steel shapes complying with ASTM A 36/A 36M. Refer to Division 15 Section "Hangers and Supports."
 - 1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.

2.4 RECTANGULAR DUCT FABRICATION

- A. Fabricate ducts, elbows, transitions, offsets, branch connections, and other construction according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" and complying with requirements for metal thickness, reinforcing types and intervals, tie-rod applications, and joint types and intervals for pressure classes specified in this section.
 - 1. Lengths: Fabricate rectangular ducts in lengths appropriate to reinforcement and rigidity class required for pressure class.
 - 2. Deflection: Duct systems shall not exceed deflection limits according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."
- B. Transverse Joints: Prefabricated slide-on joints and components constructed using manufacturer's guidelines for material thickness, reinforcement size and spacing, and joint reinforcement. Joint types shall ensure compliance with leakage limits specified in Part 3 below.
- C. Cross Breaking or Cross Beading: Cross break or cross bead duct sides 19 inches (480 mm) and larger and 0.0359 inch (0.9 mm) thick or less, with more than 10 sq. ft. (0.93 sq. m) of nonbraced panel area unless ducts are lined.
- D. Engineered duct systems using metal gages or reinforcing less than required in the duct construction schedule are not acceptable.

PART 3 - EXECUTION

3.1 DUCT APPLICATIONS

- A. Static-Pressure Classes: Unless otherwise indicated, construct ducts according to the Performance Requirements in Part 1 and the Duct Construction Schedule at the end of this Section.
- B. All ducts shall be galvanized steel or aluminum.
- C. Aluminum duct systems shall have aluminum supports, devices, and accessories if in direct contact with the aluminum duct, or shall be physically isolated with gaskets or permanent coatings to separate dissimilar metals.

3.2 DUCT INSTALLATION

- A. Construct and install ducts according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," unless otherwise indicated.
- B. Install ducts with fewest possible joints.
- C. Install fabricated fittings for changes in directions, size, and shape and for connections.
- D. Install couplings tight to duct wall surface with a minimum of projections into duct. Secure couplings with sheet metal screws. Install screws at intervals of 12 inches (300 mm), with a minimum of 3 screws in each coupling.

- E. Install ducts, unless otherwise indicated, vertically and horizontally and parallel and perpendicular to building lines; avoid diagonal runs.
- F. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- G. Install ducts with a clearance of 1 inch (25 mm), plus allowance for insulation thickness.
- H. Seal all joints and seams. Apply sealant to male end connectors before insertion, and afterward to cover entire joint and sheet metal screws.

3.3 HANGING AND SUPPORTING

- A. Support horizontal ducts within 24 inches (600 mm) of each elbow and within 48 inches (1200 mm) of each branch intersection.
- B. Support vertical ducts at maximum intervals of 16 feet (5 m) and at each floor.
- C. Install upper attachments to structures with an allowable load not exceeding one-fourth of failure (proof-test) load.

3.4 CONNECTIONS

- A. Make connections to equipment with flexible connectors according to Division 15 Section "Duct Accessories."
- B. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.5 SEAM AND JOINT SEALING

- A. Seal duct seams, joints, and penetrating according to SMACNA seal Class A or B, as required to comply with the specified duct leakage requirements.
 - 1. For pressure classes lower than 2-inch wg (500 Pa), seal transverse joints.
- B. Seal galvanized ducts with water-based joint seam sealant.
- C. Seal aluminum ducts with silicone sealant.
- D. Seal ducts before external insulation is applied.

3.6 DUCT AIR LEAKAGE

- A. Testing requirements: Perform the following field tests and inspections according to SMACNA's "HVAC Air Duct Leakage Test Manual" and prepare test reports:

1. Conduct tests before any equipment is connected that would be subject to damage from the test pressure. Provide temporary blank-offs or caps.
 2. Notify parties whose presence is necessary for the test; and in all cases, the Architect and testing and balancing subcontractor at least two normal work days prior to the actual test.
 3. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
 4. Conduct air leakage tests at static pressures indicated, test entire system at scheduled test pressure. Do not pressurize systems above test pressure. Give seven days advance notice for testing.
 5. While system is under test pressure, survey joints for audible leaks. Mark leakage points, shut down blower, and make repairs. Retest after duct sealant has dried or cured.
 6. If test duct sections exceed the allotted leakage levels, local sources of leakage, make repairs and repeat test procedures until acceptable leakage levels are demonstrated.
 7. During the installation, continuously examine ductwork to ascertain that it is sealed properly.
- B. Perform duct air leakage testing for the following air distribution systems:
1. Supply, return and exhaust ducts in heating and air conditioning systems.
 2. Exhaust systems serving toilet rooms, janitors closets, storage rooms, etc.

3.7 CLEANING NEW SYSTEMS

- A. Mark position of dampers and air-directional mechanical devices before cleaning, and perform cleaning before air balancing.
- B. Use service openings, as required, for physical and mechanical entry and for inspection.
1. Create other openings to comply with duct standards.
 2. Disconnect flexible ducts as needed for cleaning and inspection.
 3. Remove and reinstall ceiling sections to gain access during the cleaning process.
- C. Vent vacuuming system to the outside. Include filtration to contain debris removed from HVAC systems, and locate exhaust down wind and away from air intakes and other points of entry into building.
- D. Clean the following metal duct systems by removing surface contaminants and deposits:
1. Air outlets and inlets (registers, grilles, and diffusers).
 2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
 3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.

4. Coils and related components.
5. Return-air ducts, dampers, and actuators except in ceiling plenums and mechanical equipment rooms.
6. Supply-air ducts, dampers, actuators, and turning vanes.

E. Mechanical Cleaning Methodology:

1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet.
5. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.

F. Cleanliness Verification:

1. Visually inspect metal ducts for contaminants.
2. Where contaminants are discovered, re-clean and reinspect ducts.

3.8 IDENTIFICATION

- A. Mark ductwork in accordance with requirements for identification specified in Division 15 Section "Basic Mechanical Materials and Methods."

END OF SECTION 15815

SECTION 15820 - DUCT ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Volume dampers.
 - 2. Sound attenuators.
 - 3. Turning vanes.
 - 4. Duct-mounting access doors.
 - 5. Flexible connectors.
- B. Related Sections include the following:
 - 1. Division 15 Section "HVAC Instrumentation and Controls" for control dampers and actuators.

1.3 REFERENCED STANDARDS

- A. Air Movement and Control Association International, Inc.
 - 1. AMCA 500D: Laboratory Methods for Testing Dampers for Rating
- B. ASTM International
 - 1. ASTM A480/A 480M: Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip.
 - 2. ASTM A 653/A 653M: Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
 - 3. ASTM B 209: Specification for Aluminum and Aluminum-Alloy Sheet and Plate
 - 4. ASTM B 209: Specification for Aluminum and Aluminum-Alloy Sheet and Plate [Metric]
 - 5. ASTM B 221: Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
 - 6. ASTM B 221: Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes [Metric]
 - 7. ASTM E 84: Test Method for Surface Burning Characteristics of Building Materials
 - 8. ASTM E 477: Test Method for Measuring Acoustical and Airflow Performance of Duct Liner Materials and Prefabricated Silencers

- C. National Fire Protection Association
 - 1. NFPA 90A: Installation of Air Conditioning and Ventilating Systems (ANSI)
 - 2. NFPA 90B: Installation of Warm Air Heating and Air Conditioning Systems (ANSI)
- D. Sheet Metal and Air Conditioning Contractors' National Association
 - 1. HVAC Duct Construction Standards--Metal and Flexible.
- E. Underwriters Laboratories, Inc.
 - 1. UL 181: Factory-Made Air Ducts and Air Connectors
 - 2. UL 555: Fire Dampers
 - 3. UL 555C: Ceiling Dampers
 - 4. Fire Resistance Directory

1.4 SUBMITTALS

- A. Product Data: For each product specified, including the following:
 - 1. Volume dampers.
 - 2. Sound attenuators.
 - 3. Turning vanes.
 - 4. Duct-mounting access doors.
 - 5. Flexible connectors.
- B. Shop Drawings: Coordinate with required ductwork layout shop drawings. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 1. Special fittings.
 - 2. Manual-volume damper installations.
 - 3. Wiring Diagrams: Power, signal, and control wiring.

1.5 QUALITY ASSURANCE

- A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

PART 2 - PRODUCTS

2.1 SHEET METAL MATERIALS

- A. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods, unless otherwise indicated.

- B. Galvanized Sheet Steel: Lock-forming quality; complying with ASTM A 653/A 653M and having G90 (Z275) coating designation; ducts shall have mill-phosphatized finish for surfaces exposed to view.
- C. Aluminum Sheets: ASTM B 209 (ASTM B 209M), alloy 3003, temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.
- D. Extruded Aluminum: ASTM B 221 (ASTM B 221M), alloy 6063, temper T6.
- E. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.
- F. Tie Rods: Galvanized steel, 1/4-inch (6-mm) minimum diameter for lengths 36 inches (900 mm) or less; 3/8-inch (10-mm) minimum diameter for lengths longer than 36 inches (900 mm).

2.3 MANUAL VOLUME DAMPERS

- A. General Description: Factory fabricated, with required hardware and accessories. Stiffen damper blades for stability. Include locking device to hold single-blade dampers in a fixed position without vibration. Close duct penetrations for damper components to seal duct consistent with pressure class.
 - 1. Pressure Classes of 3-Inch wg (750 Pa) or Higher: End bearings or other seals for ducts with axles full length of damper blades and bearings at both ends of operating shaft.
 - 2. Where aluminum duct is required by the specifications, dampers shall be all aluminum construction.
 - 3. Provide multiple-blade damper for units 13 inches (330 mm) and larger in height, provide single-blade dampers for units 12 inches (305 mm) or less in height.
- B. Volume Dampers: Multiple- or single-blade, opposed-blade design, standard leakage rating, with linkage outside airstream, and suitable for horizontal or vertical applications.
 - 1. Steel Frames: Hat-shaped, galvanized sheet steel channels, minimum of 0.064 inch (1.62 mm) thick, with mitered and welded corners; frames with flanges where indicated for attaching to walls and flangeless frames where indicated for installing in ducts.
 - 2. Roll-Formed Steel Blades: 0.064-inch- (1.62-mm-) thick, galvanized sheet steel.
 - 3. Aluminum Frames: Hat-shaped, 0.10-inch- (2.5-mm-) thick, aluminum sheet channels; frames with flanges where indicated for attaching to walls; and flangeless frames where indicated for installing in ducts.
 - 4. Roll-Formed Aluminum Blades: 0.10-inch- (2.5-mm-) thick aluminum sheet.
 - 5. Extruded-Aluminum Blades: 0.050-inch- (1.2-mm-) thick extruded aluminum.
 - 6. Blade Axles: Galvanized steel.
 - 7. Bearings: Molded synthetic.
 - Tie Bars and Brackets: Galvanized steel or Aluminum.

- C. Jackshaft: 1-inch- (25-mm-) diameter, galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
 - 1. Length and Number of Mountings: Appropriate to connect linkage of each damper in multiple-damper assembly.
- D. Damper Hardware: Zinc-plated, die-cast core with dial and handle made of 3/32-inch- (2.4-mm-) thick zinc-plated steel, and a 3/4-inch (19-mm) hexagon locking nut. Include center hole to suit damper operating-rod size. Include extended platform for insulated duct mounting.

2.9 SOUND ATTENUATORS

- A. General Description: Factory-fabricated and -tested, rectangular attenuators with performance characteristics and physical requirements as indicated.
- B. Fire Performance: Adhesives, sealants, packing materials, and accessory materials shall have fire ratings not exceeding 25 for flame-spread index and 50 for smoke-developed index when tested according to ASTM E 84.
- C. Rectangular Units: Fabricate casings with a minimum of 0.034-inch- (0.85-mm-) thick, solid galvanized sheet metal for outer casing and 0.022-inch- (0.55-mm-) thick, ASTM A 653/A 653M, G90 (Z275), perforated galvanized sheet metal for inner casing and baffles.
- D. Provide sound attenuators for CVC Generator Vault as noted on the drawings.

2.10 TURNING VANES

- A. Fabricate to comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for vanes and vane runners. Vane runners shall automatically align vanes.
- B. Manufactured Turning Vanes: Fabricate 1-1/2-inch- (38-mm-) wide, double-vane, curved blades of galvanized sheet steel set 3/4 inch (19 mm) o.c.; support with bars perpendicular to blades set 2 inches (50 mm) o.c.; and set into vane runners suitable for duct mounting.

2.11 DUCT-MOUNTING ACCESS DOORS

- A. General Description: Fabricate doors airtight and suitable for duct pressure class.
- B. Door: Double wall, duct mounting, and rectangular; fabricated of minimum 24 gauge galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class. Include vision panel where indicated. Include continuous piano hinge and cam latches.
 - 1. Frame: Galvanized sheet steel, with bend-over tabs and neoprene or foam gaskets.
 - 2. Provide number of cam latches as follows:

- a. Up to 18 Inches (450 mm) Square: Two cam latches.
- b. Up to 24 by 48 Inches (600 by 1200 mm): Two compression latches with outside and inside handles.
- c. Sizes 24 by 48 Inches (600 by 1200 mm) and Larger: Two compression latches with outside and inside handles.

2.12 FLEXIBLE CONNECTORS

- A. General Description: Flame-retardant or noncombustible fabrics, coatings, and adhesives complying with UL 181, Class 1.
- B. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches (89 mm) wide attached to two strips of 2-3/4-inch- (70-mm-) wide, 0.028-inch- (0.7-mm-) thick, galvanized sheet steel or 0.032-inch- (0.8-mm-) thick aluminum sheets. Select metal compatible with ducts.
- C. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.
 - 1. Minimum Weight: 26 oz./sq. yd. (880 g/sq. m).
 - 2. Tensile Strength: 480 lbf/inch (84 N/mm) in the warp and 360 lbf/inch (63 N/mm) in the filling.
 - 3. Service Temperature: Minus 40 to plus 200 deg F (Minus 40 to plus 93 deg C).

2.14 DUCT ACCESSORY HARDWARE

- A. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 - EXECUTION

3.1 APPLICATION AND INSTALLATION

- A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards—Metal and Flexible" for metal ducts.
- B. Provide duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel ducts, and aluminum accessories in aluminum ducts.
- C. Provide balancing dampers at points on supply, return, and exhaust systems where branches lead from larger ducts as required for air balancing. Install at a minimum of two duct widths from branch takeoff.
- D. Provide turning vanes in 90-degree square elbows.
- E. Installing duct access doors:
 - 1. Install duct access doors in ductwork for access to fire dampers, smoke dampers, ATC dampers, controls, vortex dampers, duct coils, control devices, and any other

- devices, equipment, or components requiring maintenance, service, or adjustment and located inside ducts or adjacent equipment.
 - 2. Provide OSHA-approved labels on doors enclosing fire protection devices. Labels shall have lettering at least 1/2 inch (13 mm) high describing the protection device enclosed.
- F. Installing sound attenuators:
- 1. Where multiple units are used, seal joints after making connections. Provide steel bands around multiple units. Install duct-mounted units with transitions where required, and pressure test with ductwork.
- G. Install duct access doors to allow for inspecting, adjusting, and maintaining accessories and terminal units as follows:
- 1. On both sides of duct coils.
 - 2. Downstream from volume dampers and equipment.
 - 3. On sides or bottom of ducts where adequate clearance is available.
- H. Install the following minimum sizes for duct-mounting, rectangular access doors:
- 1. Head and Hand Access: 16 by 16 inches (406 by 406 mm).
 - 2. Body Plus Ladder Access: 24 by 18 inches (607 by 455 mm).
- I. Label access doors according to Division 15 Section "Mechanical Identification."
- J. Install flexible connectors immediately adjacent to equipment in ducts associated with fans and motorized equipment supported by vibration isolators.
- K. For fans developing static pressures of 5-inch wg (1250 Pa) and higher, confirm with manufacturer that material is suited for system pressure.
- L. Connect diffusers to low pressure ducts directly.
- 3.3 ADJUSTING
- A. Adjust duct accessories for proper settings.
 - B. Final positioning of manual-volume dampers is specified in Division 15 Section "Testing, Adjusting, and Balancing."

END OF SECTION 15820

SECTION 15836 - AXIAL FANS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following: Propeller fans.

1.3 PERFORMANCE REQUIREMENTS

- A. Project Altitude: Base fan performance ratings on sea level.
- B. Operating Limits: Classify according to AMCA 99.

1.4 SUBMITTALS

- A. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated and include the following:
 - 1. Certified fan performance curves with system operating conditions indicated.
 - 2. Certified fan sound-power ratings.
 - 3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
 - 4. Material thickness and finishes, including color charts.
 - 5. Dampers, including housings, linkages, and operators.
 - 6. Fan speed controllers.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 1. Wiring Diagrams: Power, signal, and control wiring.
 - 2. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
- C. Field quality-control test reports.
- D. Operation and Maintenance Data: For axial fans to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

- B. AMCA Compliance: Products shall comply with performance requirements and shall be licensed to use the AMCA-Certified Ratings Seal.
- C. NEMA Compliance: Motors and electrical accessories shall comply with NEMA standards.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver fans as factory-assembled units, to the extent allowable by shipping limitations, with protective crating and covering.
- B. Disassemble and reassemble units, as required for moving to final locations, according to manufacturer's written instructions.
- C. Lift and support units with manufacturer's designated lifting or supporting points.

PART 2 - PRODUCTS

2.1 PROPELLER FANS

- A. Description: Direct-drive propeller fans, as indicated, consisting of fan blades, hub, housing, orifice ring, motor, drive, and accessories.
- B. Housings: Galvanized steel sheet with flanged edges and integral orifice ring with baked-enamel finish coat after assembly.
- C. Steel Fan Wheels: Formed-steel riveted to heavy-gage steel spider bolted to cast-iron hub.
- D. Accessories: The following accessories are required as indicated.
 - 1. Motor-Side Back Guard: Galvanized steel, conforming to OSHA specifications, removable for maintenance.
 - 2. Wall Sleeve: Galvanized steel to match fan and accessory size.
 - 3. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted inside fan housing, factory wired through an internal aluminum conduit.

2.2 SOURCE QUALITY CONTROL

- A. Sound-Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.
- B. Fan Performance Ratings: Establish flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests and ratings according to AMCA 210, "Laboratory Methods of Testing Fans for Rating."

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install axial fans level and plumb.
- B. Support suspended units from structure using threaded steel rods and spring hangers having a static deflection of 1 inch (25 mm). Vibration-control devices are specified in Division 15 Section "Mechanical Vibration and Seismic Controls."
- C. Install units with clearances for service and maintenance.
- D. Label fans according to requirements specified in Division 15 Section "Mechanical Identification."

3.2 CONNECTIONS

- A. Duct installation and connection requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of ducts and duct accessories.
- B. Connect wiring according to Division 16 Section "Conductors and Cables."

3.3 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
 - 1. Verify that shipping, blocking, and bracing are removed.
 - 2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
 - 3. Verify that cleaning and adjusting are complete.
 - 4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
 - 5. Adjust damper linkages for proper damper operation.
 - 6. Verify lubrication for bearings and other moving parts.
 - 7. Verify that manual and automatic volume control dampers in connected ductwork systems are in fully open position.
 - 8. Disable automatic temperature-control operators, energize motor and confirm proper motor rotation and unit operation, adjust fan to indicated rpm, and measure and record motor voltage and amperage.
 - 9. Shut unit down and reconnect automatic temperature-control operators.
 - 10. Remove and replace malfunctioning units and retest as specified above.
- B. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.4 ADJUSTING

- A. Adjust damper linkages for proper damper operation.

- B. Lubricate bearings.

END OF SECTION 15836

SECTION 15855 - DIFFUSERS, REGISTERS, AND GRILLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes ceiling-mounted diffusers, registers, and grilles.
- B. Related Sections:
 - 1. Division 15 Section "Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.
 - 3. Division 15 Section "Testing, Adjusting, and Balancing" for balancing air devices.

1.3 REFERENCED STANDARD

- A. American Society of Heating, Refrigerating and Air-Conditioning Engineers
 - 1. ASHRAE 70: Method of Testing for Rating the Performance of Air Outlets and Inlets (ANSI)

1.4 SUBMITTALS

- A. Product Data: For each product indicated, include the following:
 - 1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
 - 2. Diffuser, Register, and Grille Schedule: Indicate Drawing designation, room location, quantity, model number, size, and accessories furnished.

PART 2 - PRODUCTS

2.1 DIFFUSERS, REGISTERS, AND GRILLES, GENERAL

- A. See architectural drawings for type of walls and ceilings where diffusers, grilles, and registers are required. Coordinate margin and frame of each device with the substrate in which it will be installed. Where devices are installed in suspended ceilings, assure that they will fit correctly in the type of suspension supports shown or specified.
- B. Materials and finish:
 - 1. Construction unless indicated otherwise: Steel or Aluminum where mounted in ceilings.

2. Aluminum devices shall be aluminum construction, including dampers, where specifications call for aluminum or stainless steel ductwork.
3. Finish: Manufacturer's standard white enamel, suitable for final finish or for field painting, unless indicated otherwise.

2.2 GRILLES AND REGISTERS

A. Adjustable Bar Grille and Register:

1. Material: Steel or Aluminum.
2. Finish: Baked acrylic white.
3. Face Blade Arrangement: Adjustable horizontal and adjustable vertical spaced 1/2 inch (13 mm) apart.
4. Rear Blade Arrangement: Adjustable horizontal and adjustable vertical spaced 1/2 inch (13 mm) apart.
5. Frame: 1 inch (25 mm) wide. Resistance welded mitered corners.
6. Mounting: Countersunk screw.
7. Damper Type: Adjustable opposed-blade assembly.
8. Accessories: Front-blade gang operator.

2.3 CEILING DIFFUSER OUTLETS

A. Louver Face Diffuser:

1. Material: Steel or Aluminum.
2. Finish: Baked enamel, white or anodized aluminum.
3. Panel Size: 24 by 24 inches (600 by 600 mm).
4. Mounting: Surface with beveled frame.
5. Neck Size: Indicated on drawings.
6. Pattern: Indicated on drawings core style.
7. Dampers: Combination damper and grid.
8. Accessories:
 - a. Opposed-blade damper
 - b. Equaling grid.
 - c. Plaster ring.
 - d. Safety chain.

2.4 SOURCE QUALITY CONTROL

- A. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install diffusers, registers, and grilles level and plumb.
- B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practicable. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.
- C. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.3 ADJUSTING

- A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 15855

SECTION 15861 - AIR FILTERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes factory-fabricated air-filter devices and media used to remove particulate matter from air for HVAC applications, including filter frames, filter housings and filter gages.
- B. Related Sections:
 - 1. Division 15 Section "Basic Mechanical Materials and Methods."
 - 2. Division 15 Section "Fan-Coil Units."

1.3 REFERENCED STANDARDS

- A. Air-Conditioning & Refrigeration Institute
 - 1. ARI 850: Commercial and Industrial Air Filter Equipment
- B. American Society of Heating, Refrigerating and Air-Conditioning Engineers
 - 1. ASHRAE 52.1: Gravimetric and Dust-Spot Procedures for Testing Air-Cleaning Devices Used in General Ventilation for Removing Particulate Matter (ANSI)
 - 2. ASHRAE 52.2: Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size (ANSI)
- C. ASME International
 - 1. ASME N510: Testing of Nuclear Air Treatment Systems
- D. Institute of Environmental Sciences and Technology www.iest.org
 - 1. IEST-RP-CC001.3: HEPA and ULPA Filters
 - 2. IEST-RP-CC007.1: Testing ULPA Filters
- E. Underwriters Laboratories Inc.
 - 1. UL 586: High-Efficiency, Particulate, Air-Filter Units

1.4 DEFINITIONS

- A. DOP: Dioctyl phthalate or bis-(2-ethylhexyl) phthalate.
- B. HEPA: High-efficiency particulate air.
- C. MERV: Minimum Efficiency Reporting Value.
- D. ULPA: Ultra low penetration air.

1.5 SUBMITTALS

- A. Product Data: Include dimensions; operating characteristics and weights; required clearances and access; rated flow capacity, including initial and final pressure drop at rated airflow; efficiency and test method; fire classification; furnished specialties; and accessories for each model indicated.
- B. Shop Drawings: Include plans, elevations, sections, and details to illustrate component assemblies and attachments.
 - 1. Show filter rack assembly, dimensions, materials, and methods of assembly of components.
 - 2. Include setting drawings, templates, and requirements for installing anchor bolts and anchorages.
- C. Operation and Maintenance Data: For each type of filter and rack to include in operation and maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Product Options: Drawings indicate size, profiles, and dimensional requirements of air filters.
- B. Comply with ARI 850.
- C. Comply with ASHRAE 52.1 and ASHRAE 52.2 for method of testing and rating air-filter units.

1.7 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 3.

1.8 REDUNDANT MATERIALS

- A. Furnish redundant materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Provide one complete set of filters for each filter bank for start up.

PART 2 - PRODUCTS

2.1 EXTENDED-SURFACE, DISPOSABLE PANEL FILTERS (30 PERCENT FILTERS)

- A. Description: Factory-fabricated, dry, disposable, extended-surface pleated panel filters with holding frames.
- B. Thickness: 1 inch (25 mm).
- C. UL rating: Class 2.
- D. Rating in accordance with ASHRAE 52.1 and ASHRAE 52.2
 - 1. Average efficiency: 25 to 30 percent. MERV 6-8
 - 2. Average arrestance: 90 to 92 percent.
- E. Media: Fibrous material formed into deep-V-shaped pleats and held by self-supporting wire grid.
- F. Media and Media-Grid Frame: Nonflammable cardboard.
- G. Duct-Mounting Frames: Welded, galvanized steel with gaskets and fasteners, and suitable for bolting together into built-up filter banks.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install filter frames according to manufacturer's written instructions.
- B. Position each filter unit with clearance for normal service and maintenance. Anchor filter holding frames to substrate.
- C. Install one complete set of new filters at completion of cleaning and prior to testing, adjusting, and balancing. Install filters in position to prevent passage of unfiltered air.
- D. Coordinate filter installations with duct and fan-coil unit installations.

3.2 FIELD QUALITY CONTROL

- A. Inspect, test, and adjust field-assembled components, filter and filter-frame installation. Report results in writing.

3.3 CLEANING

- A. After completing system installation and prior to testing, adjusting, and balancing of air-handling systems, clean filter housings.

END OF SECTION 15861

SECTION 15900 - HVAC INSTRUMENTATION AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes:

- 1. Building Automation System (BAS).
- 2. Monitoring and control equipment and wiring for engine generator and fuel oil system.
- 3. Control equipment for HVAC systems and components, including control components for terminal heating and cooling units not supplied with factory-wired controls.

- B. Products Furnished but Not Installed under this Section

- 1. Automatic control valves, and insertion wells in piping: For installation under Division 15 Section "Hydronic Piping."
- 2. Dampers: For installation under Division 15 Section "Duct Accessories."

- C. Related Sections include the following:

- 1. Division 15 Sections specifying equipment operated by a control system, equipment being packaged with control components that interface with the control system, or equipment in which control components will be factory installed.
- 2. Division 15 Section "Motors" for default motor characteristics such as NEMA designation, temperature rating, service factor, enclosure type, and efficiency.
- 3. Division 15 Section "Mechanical Vibration Controls" for vibration isolation devices.
- 4. Division 15 Section "Mechanical Identification" for labels, equipment markers, and nameplates and for installation requirements to identify control components.
- 5. Division 15 Section "Hydronic Piping" for installation requirements for instrument wells, valves, and other accessories.
- 6. Division 15 Section "Duct Accessories" for installation requirements for automatic dampers.
- 7. Division 16 Section "Conductors and Cables" for building and control wires.
- 8. Division 16 Section "Raceways and Boxes" for pull, junction, and outlet boxes and for cabinets.
- 9. Division 16 Section "Generators" for engine generator, day tank, and accessories.

1.3 REFERENCED STANDARDS

- A. Air Movement and Control Association International, Inc.

1. AMCA 500D: Methods of Testing Dampers for Rating
- B. American Society of Heating, Refrigerating and Air-Conditioning Engineers
 1. ASHRAE 135: BACnet - A Data Communication Protocol for Building Automation and Control Networks
- C. Architect of the Capitol
 1. BAS Master Plan.
 2. AIP: Building Automation and Control System Communication Integration Plan (AIP) for the Capitol complex.
- D. ASME International
 1. ASME B16.18: Cast Copper Alloy Solder Joint Pressure Fittings
 2. ASME B16.22: Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
- E. ASTM International
 1. ASTM A 126: Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings
 2. ASTM A 536: Specification for Ductile Iron Casting
 3. ASTM B 88: Specification for Seamless Copper Water tube
 4. ASTM B 88M: Specification for Seamless Copper Water Tube [**Metric**]
 5. ASTM B 280: Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.
- F. Electronic Industries Alliance/Canadian Electricity Association
 1. EIA/CEA 709.1-B: Control Network Protocol Specification
- G. The Instrumentation, Systems, and Automation Society (67 Alexander Dr., Research Triangle Park, NC 27709; 919-549-8411)
 1. ISA 50.00.01: Compatibility of Analog Signals for Electronic Industrial Process Instruments
- H. National Electrical Manufacturers Association
 1. NEMA 250: Enclosures for Electrical Equipment (100 Volts Maximum)
- I. NFPA
 1. NFPA 70: National Electrical Code

1.4 DEFINITIONS

- A. DDC: Direct digital control.
- B. I/O: Input/output.
- C. BACnet: A control network technology platform for designing and implementing interoperable control devices and networks.
- D. MS/TP: Master slave/token passing.
- E. BAS: Building automation system.
- F. CU: Control Unit.
- G. DAC: Direct analog controls.
- H. DDC: Direct-digital controls.
- I. LAN: Local area network.
- J. LANID: LAN interface device.
- K. OI: Operator Interface.
- L. PCWS: Personal computer workstation.
- M. PICS: Protocol Implementation Conformance Statement.
- N. POT: Portable Operators Terminal.
- O. PID: Proportional plus integral plus derivative.
- P. RTD: Resistance temperature detector.

1.5 SYSTEM DESCRIPTION

- A. In the Capitol Building and the Capitol Visitor Center, provide extensions of existing BAS of direct digital temperature controls with electronic and electric actuation.
- B. BAS consists of totally native BACnet-based distributed logic control system complete with Direct Digital Control (DDC) and Direct Analog Control (DAC) software and operators workstation. System Local Area Network Interface Devices (LANID), Control Units (CU) and input/output devices shall communicate using protocols and Local Area Network (LAN) standards as defined by ANSI/ASHRAE Standard 135-2004, BACnet.
- C. The BAS shall communicate with the AoC BASnet servers, through the existing AoC campuswide fiber ethernet network. The existing BASnet server uses Automated Logic Corporation (ALC) WebCTRL v2.5 Software–Thin Client–Web Browser Based GUI, using BACnet/IP. Each building has an existing CISCO 4503 switch and ethernet backbone, which this BAS shall utilize. Both fiber optic and CAT-5e connections shall be available.

Coordinate with AoC for all cabling, addressing and other requirements. The new BAS will be connected to, share points with, and allow total communication with the existing AoC Building Automation System Network.

1. Do not install additional computers or software at the host computer location to meet the workstation communication requirements.
2. In the U. S. Capitol Building, the fan coil units' controllers, serving electrical substations located in Rooms ST-49 and HT-49, shall communicate through CISCO 2950 CAT-5 Ethernet hubs located in Room ST-25 and HT-23. Provide Ethernet routers to communicate between Ethernet hubs and new DDC controllers. Provide graphics for fan coil units on existing DDC workstations and servers.
3. In the Capitol Visitor Center, controllers and monitoring sensors, serving the engine generator, day tank, exhaust fan and accessories in the Generator Vault, shall communicate using the existing MS/TP trunk. Provide graphics for engine generator, day tank and exhaust fan on existing DDC workstations and servers.
4. Provide transformers, power supplies, devices, wiring and connections for all new control functions.

1.6 SYSTEM PERFORMANCE

A. Comply with the following performance requirements:

1. Graphic Display: Display graphic with minimum 20 dynamic points with current data within 10 seconds.
2. Graphic Refresh: Update graphic with minimum 20 dynamic points with current data within 8 seconds.
3. Object Command: Reaction time of less than two seconds between operator command of a binary object and device reaction.
4. Object Scan: Transmit change of state and change of analog values to control units or workstation within six seconds.
5. Alarm Response Time: Annunciate alarm at workstation within 45 seconds. Multiple workstations must receive alarms within five seconds of each other.
6. Program Execution Frequency: Run capability of applications as often as five seconds, but selected consistent with mechanical process under control.
7. Performance: Programmable controllers shall execute DDC PID control loops, and scan and update process values and outputs at least once per second.
8. Reporting Accuracy and Stability of Control: Report values and maintain measured variables within tolerances as follows:
 - a. Space Temperature: Plus or minus 1 deg F (0.5 deg C).
 - b. Electrical: Plus or minus 5 percent of reading.

1.7 BUILDING AUTOMATION AND CONTROL SYSTEM INTEROPERABILITY AND NETWORKING

A. Requirements for network connections

1. All control devices meeting the B-BC device profile shall be connected to an ISO 8802-3 (Ethernet) LAN designated by the AoC. Unless otherwise specified, the connection shall be via a 10BASE-T port supplied by the AoC.
2. Control devices that meet the B-ASC profile, but do not support Ethernet, must use another approved BACnet LAN technology. These technologies are ARCNET and MS/TP. If Ethernet is not supported on any part of the internetwork, a standalone BACnet router, or a BACnet Building Controller with built-in routing capability, must be provided for routing between the Ethernet and ARCNET or MS/TP LANs.

B. Data Sharing

1. Data Sharing requirements apply to the exchange of information between BACnet devices for archival storage, generating graphics and reports, the sharing of common sensor or calculated values, carrying out interlocked control strategies, and the modification of setpoints or other operational parameters.
2. All such data to be exchanged shall be represented as BACnet objects and conveyed using BACnet messages. Only standard BACnet objects and messages may be used to implement data sharing requirements.
3. Data Presentation: Provide and configure devices to generate the following tabular reports.
 - a. Fan status report: A report that shows the status of all air handling units divided by building. This should indicate fan number, status of supply fans, return fans and exhaust fans as appropriate.
 - b. Open Alarm status report: A report that shows all open alarms by system, building and point. It shall also provide the time of the alarm.
 - c. Network errors report: A report that details any network errors and provides location and time of error.
4. Provide graphic displays on existing BAS workstations and configure devices to depict all point data indicated on the drawings but not less than the following:
 - a. Building floor plan indicating temperature and relative humidity where measured.
 - b. Fan-coil units and exhaust fans: Temperatures, fan status and speed, control valve positions, damper positions, and control loop setpoints.
 - c. Other building processes that are represented on the points list provided on the drawings
5. The graphic displays shall include schematic diagrams of the systems being displayed.
6. When a graphic display is being viewed all values displayed shall be updated when a change of value (COV) notification is received or, if COV is not implemented, within five seconds.
7. Setpoint and parameter modifications: Operators with appropriate authority shall be able to modify all control loop setpoints and tuning parameters via BACnet messages initiated through operator interaction with graphics displays.
8. Peer-to-peer data dependencies: All BACnet devices shall be installed and configured to exchange data values directly, without the need of operator or

workstation intervention, to implement the sequence of operations specified in the mechanical system drawings and to share global data values.

- C. Alarm and Event Management: Alarm and Event management is the exchange of data between BACnet devices related to the occurrence of a predefined condition that meets specific criteria. Such conditions are called "events" and may be the basis for the initiation of a particular control action in response or the simple logging of the event's occurrence. The event may also be deemed to represent a condition that constitutes an "alarm" requiring human acknowledgment and intervention.
1. All alarms and events shall be implemented using standard BACnet event detection and notification mechanisms. Either intrinsic reporting or algorithmic change reporting may be used but the intrinsic reporting method is preferred. The requirements in AIP 3.1.2 and AIP 3.3.2 shall apply.
 2. Alarm lists:
 - a. The vendor shall provide devices installed and configured to detect alarms and events for all points as indicated in the system drawings. Software logic shall be provided to avoid nuisance alarms, e.g., no temperature or status alarms when fan systems are not running or during start-up and shut-down transitions. It shall be possible to configure a delay between the occurrence of an alarm condition and its enunciation.
 - b. Alarms shall appear at the operator workstation(s) within five seconds of their occurrence. The workstations shall display an alarm message window that appears on top of any other open windows. The alarm message window shall have a distinctive color and appearance to attract the operator's attention. Operators with sufficient privilege shall be able to configure the workstation to emit an audible signal (or not) when an alarm message is received.
 - c. Alarms that require operator acknowledgment shall cause the alarm window to remain active until such an acknowledgment is received. If multiple alarms are received, unacknowledged alarms shall be displayed on a first come first served basis grouped by priority, with the highest priority alarms displayed first.
 - d. Alarms shall be distributed using the BACnet notification class mechanism. Assignment of classes and destinations shall be configured according to details provided by the AoC. A list of alarms and destinations are provided on the drawings.
 - e. Alarm priorities shall be configured as indicated in the AIP
 3. Alarm acknowledgment: The ability of an operator to acknowledge an alarm shall be determined by assigned operator privilege levels. A log shall be maintained that records when an alarm notification is received, when it is acknowledged, and by whom.
 4. Alarm summarization: It shall be possible for any operator to receive a summary of all alarms regardless of acknowledgment status; for which a particular recipient is enrolled for notification; based on current event state; based on the particular BACnet event algorithm (e.g., change of value, change of state, out of range, and so on); alarm priority; and notification class.

5. Alarm parameter adjustment: Operators with sufficient privilege shall be able to change alarm parameters for all standard BACnet event types.
 6. Alarm routing adjustment : Operators with sufficient privilege shall be able to change alarm routing (BACnet notification classes) for each alarm including the destination for each type of alarm and alarm priority, the day of week and time of day, and the type of transition involved (TO-OFFNORMAL, TO-NORMAL, etc.).
 - a. Initially, notification classes shall be configured in a manner that distinguishes between the jurisdictions of the facilities involved and to meet any other operational needs requested by the AoC.
 - b. Additional details regarding alarm classes and destinations are provided on the drawings.
- D. Scheduling: Scheduling is the exchange of data between BACnet devices related to the establishment and maintenance of dates and time at which specified output actions are to be taken. All schedules shall be implemented using BACnet objects and messages. The requirements in AIP 3.1.3 and AIP 3.3.3 shall apply.
- E. Trending: Trending is the accumulation of (time, value) data pairs at specified rates for a specified duration. Trends are distinguished from real-time plotting of data by the fact that the data are destined for long-term storage. The requirements in AIP 3.1.4 and AIP 3.3.4 shall apply.
- F. Device and Network Management: Device and network management is the exchange of data between BACnet devices concerning the operation and status of specific devices. The requirements in AIP 3.1.5 and AIP 3.3.5 shall apply.
- G. BACnet Communication:
1. Interoperable commands: Dampers, valves, fans, and other mechanical equipment that may need to be controlled by more than one application shall be represented as commandable BACnet objects. The application programs interacting with this equipment shall be configured to use the command priorities listed in Table 1. If implementing the sequence of operations or other required functionality requires using a command priority not listed in Table 1, the priority assignment must be approved by the AoC.

Table 1. Capitol Complex Command Priorities

Priority Level	Application	Priority Level	Application
1	Manual-Life Safety	9	Available
2	Automatic-Life Safety	10	Available
3	Available	11	Emergency Curtailment level 3
4	Available	12	Curtailment level 2
5	Critical Equipment Control	13	In Session
6	Minimum On/Off	14	Curtailment level 1
7	Available	15	Available
8	Manual Operator	16	Available

2. Alarming
 - a. Alarm priorities: Configure alarms and event notification priorities as specified in AIP Appendix C.
 - b. Notification class: Points relative to building operations shall be placed in the Capitol notification class. Coordinate with the AoC.
 - c. The Priority, Action Required, and Recipient List properties of Notification Class objects shall be writable over the network using BACnet services.
 - d. Event Notification message texts: Alarm and event processing shall be configured to convey descriptive text messages along with the notification.
3. Operator authority levels: Operator access to BACnet services shall be restricted based on existing BAS operator authority as designated by the AoC.

1.8 SEQUENCE OF OPERATION

- A. Sequence of operation for automatically controlled equipment is shown on drawings. ATC subcontractor shall cooperate with the unit suppliers and provide all relays and wiring required to integrate the sequence of operation.

1.9 SUBMITTALS

- A. Contractor qualifications: Submit evidence of installer qualifications specified in "Quality Assurance" below.
 1. Include project name, address, name and phone number of Owner's representative and project size and type.
- B. Product Data: Include manufacturer's technical literature for each control device. Indicate dimensions, capacities, performance characteristics, electrical characteristics, finishes for materials, and installation and startup instructions for each type of product indicated. Submit ASHRAE BACnet Performance Implementation Conformance (PIC) statements for each DDC system component (panel, zone controller, field devices, and operator workstation) proposed.
 1. DDC System Hardware: Bill of materials of equipment indicating quantity, manufacturer, and model number. Include technical data for operator workstation equipment, interface equipment, control units, transducers/transmitters, sensors, actuators, valves, relays/switches, control panels, and operator interface equipment.
 2. Control System Software: Include technical data for operating system software, operator interface, color graphics, and other third-party applications.
 3. Controlled Systems: Instrumentation list with element name, type of device, manufacturer, model number, and product data. Include written description of sequence of operation including schematic diagram.
- C. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Bill of materials of equipment indicating quantity, manufacturer, and model number.
2. Schematic flow diagrams showing engine generators, day tanks, exhaust fans, fan-coil units, dampers, valves, and control devices.
3. Wiring Diagrams: Power, signal, and control wiring.
4. Details of control panel faces, including controls, instruments, and labeling.
5. Schedule of dampers including size, leakage, and flow characteristics.
6. Schedule of valves including flow characteristics.
7. DDC System Hardware:
 - a. Wiring diagrams for control units with termination numbers.
 - b. Schematic diagrams and floor plans for field sensors and control hardware.
 - c. Schematic diagrams for control, communication, and power wiring, showing trunk data conductors and wiring between operator workstation and control unit locations.
8. Control System Software: List of color graphics indicating monitored systems, data (connected and calculated) point addresses, output schedule, and operator notations.
9. Controlled Systems:
 - a. Schematic diagrams of each controlled system with control points labeled and control elements graphically shown, with wiring.
 - b. Scaled drawings showing mounting, routing, and wiring of elements including bases and special construction.
 - c. Written description of sequence of operation including schematic diagram.
 - d. Points list.
- D. Software, Firmware and Hardware Operational Documentation: Include the following:
 1. Engineering, installation, operation and maintenance manuals that include design and installation of new points, panels, and other hardware; preventive maintenance and calibration; solving hardware problems; and repair and replacement of hardware.
 2. Program Software Backup: On a magnetic media or compact disc, complete with data files.
 3. Device address list.
 4. Printout of software application and graphic screens.
 5. Software license required by and installed for DDC workstations and control systems.
- F. Software Upgrade Kit: For Owner to use in modifying software to suit future systems revisions or monitoring and control revisions.
- G. Qualification Data: For Installer and manufacturer.
- H. Field quality-control test reports.
- I. Operation and Maintenance Data: For HVAC instrumentation and control system to

include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 Section "Operation and Maintenance Data," include the following:

1. Maintenance instructions and lists of spare parts for each type of control device and compressed-air station.
 2. Interconnection wiring diagrams with identified and numbered system components and devices.
- J. Project Record Documents: Record actual locations of control components, including control units, thermostats, and sensors. Revise Shop Drawings to reflect actual installation and operating sequences.

1.10 QUALITY ASSURANCE

- A. Installer Qualifications: Automatic control system manufacturer's authorized representative of the manufacturer specified in Part 2 below, who is trained and approved for installation of system components required for this Project.
- B. Qualified subcontractor shall prepare control diagrams.
- C. Perform work in accordance with the plumbing, electrical, building, fire and safety codes of the state, county, or city in which the work is performed.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.12 COORDINATION

- A. Coordinate controls, wiring and interconnections with engine generator, day tank and accessories specified in Division 16 Section "Generators."
- B. Coordinate location of thermostats, and other exposed control sensors with plans and room details before installation.

1.13 EQUIPMENT AND MATERIALS LIST

- A. Develop a comprehensive equipment and materials list for all control components installed under this contract. Organize list for ease of access by the Government's maintenance department. Include, as a minimum, a component type or name, duty, size, make and model number. Review list with the owner and recommend components and quantities that should be stored on site.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with requirements, provide instrumentation and controls manufactured by one of the following:

1. Alerton.
2. Automated Logic.
3. Delta.

2.2 DDC EQUIPMENT

- A. Operator Workstations: Existing PC-based microcomputer(s) in Ford HOB, U.S. Capitol Building, and Capitol Visitor Center.
- B. Diagnostic Terminal Unit: Existing portable notebook-style, PC-based microcomputer terminals capable of accessing system data by connecting to system network located in Senate Engineer's Office in U.S. Capitol Building.
- C. Control Units: Modular, comprising processor board with programmable, nonvolatile, random-access memory; local operator keypad and display panel for each building controller and advanced application controller; and integral interface equipment.
 1. Units monitor or control each I/O point; process information; execute commands from other control units, devices, and operator stations; and download from or upload to operator workstation or diagnostic terminal unit.
 2. Stand-alone mode control functions operate regardless of network status. Functions include the following:
 - a. Global communications.
 - b. Discrete/digital, analog, and pulse I/O.
 - c. Monitoring, controlling, or addressing data points.
 - d. Software applications, scheduling, and alarm processing.
 - e. Testing and developing control algorithms without disrupting field hardware and controlled environment.
 3. Standard Application Programs:
 - a. Electric Control Programs: On-off control with differential sequencing, antishort cycling, PID control, and trend logging.
 - b. Programming Application Features: Include trend point; alarm processing and messaging; run-time totalization; and security access.
 - d. Remote communications.
 - e. Units of Measure: Inch-pound.
 4. Local operator interface provides for download from or upload to operator workstation or diagnostic terminal unit.
 5. Communication Gateways, which convert any other communications protocol to BACnet, are strictly prohibited.
- D. Local Control Units: Modular, comprising processor board with electronically programmable, nonvolatile, read-only memory; and backup power source.
 1. Units monitor or control each I/O point, process information, and download from or upload to operator workstation or diagnostic terminal unit.

2. Stand-alone mode control functions operate regardless of network status. Functions include the following:
 - a. Global communications.
 - b. Discrete/digital, analog, and pulse I/O.
 - c. Monitoring, controlling, or addressing data points.
 3. Local operator interface provides for download from or upload to operator workstation or diagnostic terminal unit.
- E. I/O Interface: Hardwired inputs and outputs may tie into system through controllers. Protect points so that shorting will cause no damage to controllers.
1. Binary Inputs: Allow monitoring of on-off signals without external power.
 2. Analog Inputs: Allow monitoring of low-voltage (0- to 10-V dc), current (4 to 20 mA), or resistance signals.
 3. Binary Outputs: Provide on-off or pulsed low-voltage signal, selectable for normally open or normally closed operation.
 4. Analog Outputs: Provide modulating signal, either low voltage (0- to 10-V dc) or current (4 to 20 mA).
 5. Universal I/Os: Provide software selectable binary or analog outputs.

2.3 ELECTRONIC SENSORS

- A. Description: Vibration and corrosion resistant; for wall, immersion, or duct mounting as required.
- B. Thermistor Temperature Sensors and Transmitters:
1. Accuracy: Plus or minus 0.5 deg F (0.3 deg C) at calibration point.
 2. Wire: Twisted, shielded-pair cable.
 3. Insertion Elements for Liquids: Brass or stainless-steel socket with minimum insertion length of 2-1/2 inches (64 mm).
 4. Room Sensor Cover Construction: Manufacturer's standard locking covers.
 - a. Set-Point Adjustment: Concealed.
 - b. Set-Point Indication: Keyed.
 - c. Thermometer: Exposed Spiral bimetal.
 - d. Orientation: Vertical.
- C. RTDs and Transmitters:
1. Accuracy: Plus or minus 0.5 degrees F (0.3 degrees C) at calibration point.
 2. Wire: Twisted, shielded-pair cable.
 3. Insertion Elements in Ducts: Single point, 8 inches (200 mm) long; use where not affected by temperature stratification or where ducts are smaller than 9 sq. ft. (0.84 sq. m).
 4. Averaging Elements in Ducts: Flexible, patterned across duct, length as required to cover full cross-sectional area.

5. Insertion Elements for Liquids: Brass socket with minimum insertion length of 2-1/2 inches (64 mm).
6. Room Sensor Cover Construction: Manufacturer's standard locking covers.
 - a. Set-Point Adjustment: Concealed.
 - b. Set-Point Indication: Concealed.
 - c. Thermometer: Concealed Red-reading glass.
 - e. Orientation: Vertical.

2.4 STATUS SENSORS

- A. Status Inputs for Electric Motors: Comply with ISA 50.00.01, current-sensing fixed- or split-core transformers with self-powered transmitter, adjustable trip current and suitable for 175 percent of rated motor current. Provide analog current sensors for motors.
- B. Electronic Valve/Damper Position Indicator: Visual scale indicating percent of travel and 2- to 10-V dc, feedback signal.

2.5 THERMOSTATS

- A. Electronic, Low-Voltage Thermostats Serving Fan-Coil Units: Solid-state, fully programmable, BACnet controller designed for space control applications. A built-in LCD screen and keypad shall allow an operator to view and change all points in the local fan-coil unit control system.

2.6 ACTUATORS

- A. Electronic Actuators: Direct-coupled type designed for minimum 60,000 full-stroke cycles at rated torque.
 1. Valves: Size for torque required for valve close-off at not less than 1.2 times pump shut-off pressure.
 2. Dampers: Size for running torque calculated as follows:
 - a. Parallel-Blade Damper with Edge Seals: 7 inch-lb/sq. ft. (86.8 kg-cm/sq. m) of damper.
 - b. Opposed-Blade Damper with Edge Seals: 5 inch-lb/sq. ft. (62 kg-cm/sq. m) of damper.
 - c. Dampers with 2- to 3-Inch wg (500 to 750 Pa) of Pressure Drop or Face Velocities of 1000 to 2500 fpm (5 to 13 m/s): Increase running torque by 1.5.
 - d. Dampers with 3- to 4-Inch wg (750 to 1000 Pa) of Pressure Drop or Face Velocities of 2500 to 3000 fpm (13 to 15 m/s): Increase running torque by 2.0.
 3. Coupling: V-bolt and V-shaped, toothed cradle.
 4. Overload Protection: Electronic overload or digital rotation-sensing circuitry.
 5. Fail-Safe Operation: Mechanical, spring-return mechanism. Provide external, manual gear release on nonspring-return actuators.

6. Power Requirements (Two-Position Spring Return): 24-V ac.
7. Power Requirements (Modulating): Maximum 10 VA at 24-V ac or 8 W at 24-V dc.
8. Proportional Signal: 2- to 10-V dc or 4 to 20 mA, and 2- to 10-V dc position feedback signal.
9. Temperature Rating: Minus 22 to plus 122 deg F (Minus 30 to plus 50 deg C).
10. Run Time: 12 seconds open, 5 seconds closed.

2.7 CONTROL VALVES

- A. Control Valves: Factory fabricated, of type, body material, and pressure class based on maximum pressure and temperature rating of piping system, unless otherwise indicated.
- B. Hydronic system ball valves shall have the following characteristics:
 1. NPS 2 (DN 50) and smaller: Class 250 bronze or brass body, stainless steel ball and stem, 90 degree stroke, screwed ends. Two-position valves shall be line size.
 2. Internal seals:
 - a. Ball seal: RTFE seats with EOPM o-rings.
 - b. Stem seal: Two EDPM o-rings.
 3. Flow characteristics: Provide ball with characterized insert for equal percentage flow characteristics.
 4. Close-Off (Differential) Pressure Rating: Combination of actuator and trim shall provide minimum close-off pressure rating of 150 percent of total system (pump) head for two-way valves and 100 percent of total system (pump) head for three-way valves.

2.8 DAMPERS

- A. Dampers: AMCA-rated, opposed-blade design; 0.108-inch- (2.8-mm-) minimum thick, galvanized-steel or 0.125-inch- (3.2-mm-) minimum thick, extruded-aluminum frames with holes for duct mounting; damper blades shall not be less than 0.064-inch- (1.6-mm-) thick galvanized steel with maximum blade width of 8 inches (200 mm) and length of 72 inches (830 mm).
 1. Secure blades to 1/2-inch- (13-mm-) diameter, zinc-plated axles using zinc-plated hardware, with oil-impregnated sintered bronze blade bearings, blade-linkage hardware of zinc-plated steel and brass, ends sealed against spring-stainless-steel blade bearings, and thrust bearings at each end of every blade.
 2. Operating Temperature Range: From minus 40 to plus 200 deg F (minus 40 to plus 93 deg C).
 3. Blade Edge Seals dampers requiring 100 percent closure shall have closed-cell neoprene edge seals mechanically locked into blade edge.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that power supply is available to control units.

3.2 INSTALLATION

- A. Install software in control units. Comply with point names and programming requirements specified in the Architect of the Capitol "AIP". Implement all features of programs to specified requirements and as appropriate to sequence of operation.
- B. Connect and configure equipment and software to achieve sequence of operation specified.
- C. Verify location of thermostats, and other exposed control sensors with Drawings and room details before installation. Install devices 48 inches (1220 mm) above the floor.
- D. Install guards on thermostats.
- E. Install automatic dampers according to Division 15 Section "Duct Accessories."
- F. Install damper motors on outside of duct in warm areas, not in locations exposed to outdoor temperatures.
- G. Install labels and nameplates to identify control components according to Division 15 Section "Mechanical Identification."
- H. Install hydronic instrument wells, valves, and other accessories according to Division 15 Section "Hydronic Piping."

3.3 ELECTRICAL WIRING AND CONNECTION INSTALLATION

- A. Install raceways, boxes, and cabinets according to Division 16 Section "Raceways and Boxes."
- B. Install building wire and cable according to Division 16 Section "Conductors and Cables."

3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.
- B. Perform the following field tests and inspections and prepare test reports:
 - 1. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation. Remove and replace malfunctioning units and retest.
 - 2. Test and adjust controls and safeties.
 - 3. Test calibration of electronic controllers by disconnecting input sensors and stimulating operation with compatible signal generator.
 - 4. Test each point through its full operating range to verify that safety and operating control set points are as required.

5. Test each control loop to verify stable mode of operation and compliance with sequence of operation. Adjust PID actions.
 6. Test each system for compliance with sequence of operation.
 7. Test software and hardware interlocks.
- C. DDC Verification: Provide AoC engineer with certified checkout list documenting each step of the verification process.
1. Verify that instruments are installed before calibration, testing, and loop or leak checks.
 2. Check instruments for proper location and accessibility.
 3. Check instrument installation for direction of flow, elevation, orientation, insertion depth, and other applicable considerations.
 4. Check instrument tubing for proper fittings, slope, material, and support.
 5. Check installation of air supply for each instrument.
 6. Check flow instruments. Inspect tag number and line and bore size, and verify that inlet side is identified and that meters are installed correctly.
 7. Check pressure instruments, piping slope, installation of valve manifold, and self-contained pressure regulators.
 8. Check temperature instruments and material and length of sensing elements.
 9. Check control valves. Verify that they are in correct direction.
 10. Check air-operated dampers. Verify that pressure gages are provided and that proper blade alignment, either parallel or opposed, has been provided.
 11. Check DDC system as follows:
 - a. Verify that DDC controller power supply is from emergency power supply, if applicable.
 - b. Verify that wires at control panels are tagged with their service
 - c. designation and approved tagging system.
 - d. Verify that spare I/O capacity has been provided.
 - e. Verify that DDC controllers are protected from power supply surges.
 12. Demonstrate to AoC representative compliance with the sequences of operation, through each operational mode. Demonstrate all specified software and hardware interlocks. System shall not be accepted until checklists and completed demonstration forms are submitted and approved.
- D. Replace damaged or malfunctioning controls and equipment and repeat testing procedures.

3.5 ADJUSTING

- A. Calibrating and Adjusting:
1. Calibrate instruments.
 2. Make three-point calibration test for both linearity and accuracy for each analog instrument.
 3. Calibrate equipment and procedures using manufacturer's written

recommendations and instruction manuals. Use test equipment with accuracy at least double that of instrument being calibrated.

4. Control System Inputs and Outputs:
 - a. Check analog inputs at 0, 50, and 100 percent of span.
 - b. Check analog outputs using milliamper meter at 0, 50, and 100 percent output.
 - c. Check digital inputs using jumper wire.
 - d. Check digital outputs using ohmmeter to test for contact making or breaking.
 - e. Check resistance temperature inputs at 0, 50, and 100 percent of span using a precision-resistant source.
5. Temperature:
 - a. Calibrate resistance temperature transmitters at 0, 50, and 100 percent of span using a precision-resistance source.
 - b. Calibrate temperature switches to make or break contacts.
6. Stroke and adjust control valves and dampers without positioners, following the manufacturer's recommended procedure, so that valve or damper is 100 percent open and closed.
7. Provide diagnostic and test instruments for calibration and adjustment of system.
8. Provide written description of procedures and equipment for calibrating each type of instrument. Submit procedures review and approval before initiating startup procedures.

B. Adjust initial temperature and humidity set points.

C. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to three visits to Project during other than normal occupancy hours for this purpose.

3.6 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Government's maintenance personnel to adjust, operate, and maintain HVAC instrumentation and controls. Refer to Division 1 Section "General Requirements."
- B. Provide at least two four-hour training sessions with Government personnel at times and locations as coordinated with the Architect.

END OF SECTION 15900

SECTION 15950 - TESTING, ADJUSTING, AND BALANCING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes TAB to produce design objectives for the following:
 - 1. Air Systems:
 - a. Constant-volume air systems.
 - 2. Hydronic Piping Systems.
 - 3. HVAC equipment quantitative-performance settings.
 - 4. Verifying that automatic control devices are functioning properly.
 - 5. Reporting results of activities and procedures specified in this Section.

1.3 DEFINITIONS

- A. Adjust: To regulate fluid flow rate and air patterns at the terminal equipment, such as to reduce fan speed or adjust a damper.
- B. Balance: To proportion flows within the distribution system, including submains, branches, and terminals, according to indicated quantities.
- C. Barrier or Boundary: Construction, either vertical or horizontal, such as walls, floors, and ceilings that are designed and constructed to restrict the movement of airflow, smoke, odors, and other pollutants.
- D. Draft: A current of air, when referring to localized effect caused by one or more factors of high air velocity, low ambient temperature, or direction of airflow, whereby more heat is withdrawn from a person's skin than is normally dissipated.
- E. NC: Noise criteria.
- F. Procedure: An approach to and execution of a sequence of work operations to yield repeatable results.
- G. RC: Room criteria.
- H. Report Forms: Test data sheets for recording test data in logical order.

- I. Static Head: The pressure due to the weight of the fluid above the point of measurement. In a closed system, static head is equal on both sides of the pump.
- J. Suction Head: The height of fluid surface above the centerline of the pump on the suction side.
- K. System Effect: A phenomenon that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
- L. System Effect Factors: Allowances used to calculate a reduction of the performance ratings of a fan when installed under conditions different from those presented when the fan was performance tested.
- M. TAB: Testing, adjusting, and balancing.
- N. Terminal: A point where the controlled medium, such as fluid or energy, enters or leaves the distribution system.
- O. Test: A procedure to determine quantitative performance of systems or equipment.
- P. Testing, Adjusting, and Balancing (TAB) Firm: The entity responsible for performing and reporting TAB procedures.

1.4 SUBMITTALS

- A. Qualification Data: Within 15 days from Contractor's Notice to Proceed, submit 4 copies of evidence that TAB firm and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.
- B. Contract Documents Examination Report: Within 30 days from Contractor's Notice to Proceed, submit 4 copies of the Contract Documents review report as specified in Part 3.
- C. Strategies and Procedures Plan: Within 30 days from Contractor's Notice to Proceed, submit 4 copies of TAB strategies and step-by-step procedures as specified in Part 3 "Preparation" Article. Include a complete set of report forms intended for use on this Project.
- D. Certified TAB Reports: Submit two copies of reports prepared, as specified in this Section, on approved forms certified by TAB firm.
- E. Sample Report Forms: Submit two sets of sample TAB report forms.
- F. Warranties specified in this Section.

1.5 QUALITY ASSURANCE

- A. TAB Firm Qualifications: Engage a TAB firm certified by AABC or NEBB.

- B. TAB Conference: Meet with Government's and Architect's representatives on approval of TAB strategies and procedures plan to develop a mutual understanding of the details. Ensure the participation of TAB team members, equipment manufacturers' authorized service representatives, HVAC controls installers, and other support personnel. Provide seven days' advance notice of scheduled meeting time and location.
 - 1. Agenda Items: Include at least the following:
 - a. Submittal distribution requirements.
 - b. The Contract Documents examination report.
 - c. TAB plan.
 - d. Work schedule and Project-site access requirements.
 - e. Coordination and cooperation of trades and subcontractors.
 - f. Coordination of documentation and communication flow.
- C. Certification of TAB Reports: Certify TAB field data reports. This certification includes the following:
 - 1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
 - 2. Certify that TAB team complied with approved TAB plan and the procedures specified and referenced in this Specification.
- D. TAB Report Forms: Use standard forms from AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems," or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems."
- E. Instrumentation Type, Quantity, and Accuracy: As described in AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems," Section II, "Required Instrumentation for NEBB Certification."
- F. Instrumentation Calibration: Calibrate instruments at least every six months or more frequently if required by instrument manufacturer.
 - 1. Keep an updated record of instrument calibration that indicates date of calibration and the name of party performing instrument calibration.

1.6 PROJECT CONDITIONS

- A. Full Government Occupancy: Government will occupy the site and existing building during entire TAB period. Cooperate with Government during TAB operations to minimize conflicts with operations.

1.7 COORDINATION

- A. Coordinate the efforts of factory-authorized service representatives for systems and equipment, HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist TAB activities.
- B. Notice: Provide seven days' advance notice for each test. Include scheduled test dates and times.
- C. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

1.8 WARRANTY

- A. National Project Performance Guarantee: Provide a guarantee on AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems" forms stating that AABC will assist in completing requirements of the Contract Documents if TAB firm fails to comply with the Contract Documents. Guarantee includes the following provisions:
 - 1. The certified TAB firm has tested and balanced systems according to the Contract Documents.
 - 2. Systems are balanced to optimum performance capabilities within design and installation limits.
- B. Special Guarantee: Provide a guarantee on NEBB forms stating that NEBB will assist in completing requirements of the Contract Documents if TAB firm fails to comply with the Contract Documents. Guarantee shall include the following provisions:
 - 1. The certified TAB firm has tested and balanced systems according to the Contract Documents.
 - 2. Systems are balanced to optimum performance capabilities within design and installation limits.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.
 - 1. Contract Documents are defined in the General and Supplementary Conditions of Contract.
 - 2. Verify that balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are required by the Contract Documents. Verify that quantities and locations of

these balancing devices are accessible and appropriate for effective balancing and for efficient system and equipment operation.

- B. Examine approved submittal data of HVAC systems and equipment.
- C. Examine Project Record Documents described in Division 1 Section "General Requirements."
- D. Examine design data, including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.
- E. Examine equipment performance data including fan and pump curves. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system. Calculate system effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from those presented when the equipment was performance tested at the factory. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," Sections 7 through 10; or in SMACNA's "HVAC Systems—Duct Design," Sections 5 and 6. Compare this data with the design data and installed conditions.
- F. Examine system and equipment installations to verify that they are complete and that testing, cleaning, adjusting, and commissioning specified in individual Sections have been performed.
- G. Examine system and equipment test reports.
- H. Examine HVAC system and equipment installations to verify that indicated balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are properly installed, and that their locations are accessible and appropriate for effective balancing and for efficient system and equipment operation.
- I. Examine systems for functional deficiencies that cannot be corrected by adjusting and balancing.
- J. Examine HVAC equipment to ensure that clean filters have been installed, bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.
- K. Examine terminal units, such as fan-coil units, to verify that they are accessible and their controls are connected and functioning.
- L. Examine strainers for clean screens and proper perforations.
- M. Examine equipment for installation and for properly operating safety interlocks and controls.

- N. Examine automatic temperature system components to verify the following:
 - 1. Dampers, valves, and other controlled devices are operated by the intended controller.
 - 2. Dampers and valves are in the position indicated by the controller.
 - 3. Integrity of valves and dampers for free and full operation and for tightness of fully closed and fully open positions.
 - 4. Automatic modulating and shutoff valves, including two-way valves, are properly connected.
 - 5. Thermostats are located to avoid adverse effects of sunlight, drafts, and cold walls.
 - 6. Sensors are located to sense only the intended conditions.
 - 7. Sequence of operation for control modes is according to the Contract Documents.
 - 8. Controller set points are set at indicated values.
 - 9. Interlocked systems are operating.
- O. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

- A. Prepare a TAB plan that includes strategies and step-by-step procedures.
- B. Complete system readiness checks and prepare system readiness reports. Verify the following:
 - 1. Permanent electrical power wiring is complete.
 - 2. Hydronic systems are filled, clean, and free of air.
 - 3. Automatic temperature-control systems are operational.
 - 4. Equipment and duct access doors are securely closed.
 - 5. Balance dampers are open.
 - 6. Isolating and balancing valves are open and control valves are operational.
 - 7. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
 - 8. Windows and doors can be closed so indicated conditions for system operations can be met.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

- A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems" or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and this Section.
 - 1. Comply with requirements in ASHRAE 62.1-2004, Section 7.2.2 - "Air Balancing."
- B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and

balancing, close probe holes and patch insulation with new materials identical to those removed. Restore vapor barrier and finish according to insulation Specifications for this Project.

- C. Mark equipment and balancing device settings with paint or other suitable, permanent identification material, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, to show final settings.
- D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

- A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.
- B. Prepare schematic diagrams of systems' "as-built" duct layouts.
- C. Determine the best locations in main and branch ducts for accurate duct airflow measurements.
- D. Check airflow patterns from the outside-air louvers and dampers and the return- and exhaust-air dampers, through the supply-fan discharge and mixing dampers.
- E. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- F. Verify that motor starters are equipped with properly sized thermal protection.
- G. Check dampers for proper position to achieve desired airflow path.
- H. Check for airflow blockages.
- I. Check condensate drains for proper connections and functioning.
- J. Check for proper sealing of air duct system.

3.5 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

- A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
 - 1. Measure fan static pressures to determine actual static pressure as follows:
 - a. Measure outlet static pressure as far downstream from the fan as practicable and upstream from restrictions in ducts such as elbows and transitions.
 - b. Measure static pressure directly at the fan outlet or through the flexible connection.

- c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from flexible connection and downstream from duct restrictions.
- B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.
 - 1. Measure static pressure at a point downstream from the balancing damper and adjust volume dampers until the proper static pressure is achieved.
 - a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.
 - 2. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.
- C. Measure terminal outlets and inlets without making adjustments.
 - 1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.
- D. Adjust terminal outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using volume dampers rather than extractors and the dampers at air terminals.
 - 1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.
 - 2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.6 GENERAL PROCEDURES FOR HYDRONIC SYSTEMS

- A. Prepare test reports with pertinent design data.
- B. Prepare schematic diagrams of systems' "as-built" piping layouts.
- C. Prepare hydronic systems for testing and balancing according to the following, in addition to the general preparation procedures specified above:
 - 1. Open all manual valves for maximum flow.
 - 2. Check flow-control valves for specified sequence of operation and set at indicated flow.
 - 3. Check air vents for a forceful liquid flow exiting from vents when manually operated.

3.7 PROCEDURES FOR HYDRONIC SYSTEMS

- A. Set calibrated balancing valves, if installed, at calculated presettings.
- B. Measure flow at all stations and adjust, where necessary, to obtain first balance.
 - 1. System components that have Cv rating or an accurately cataloged flow-pressure-drop relationship may be used as a flow-indicating device.
- C. Measure flow at main balancing station and set main balancing device to achieve flow that is 5 percent greater than indicated flow.
- D. Adjust balancing stations to within specified tolerances of indicated flow rate as follows:
 - 1. Determine the balancing station with the highest percentage over indicated flow.
 - 2. Adjust each station in turn, beginning with the station with the highest percentage over indicated flow and proceeding to the station with the lowest percentage over indicated flow.
 - 3. Record settings and mark balancing devices.
- E. Measure the differential-pressure control valve settings existing at the conclusions of balancing.

3.8 PROCEDURES FOR VARIABLE-FLOW HYDRONIC SYSTEMS

- A. Balance systems with automatic two- and three-way control valves by setting systems at maximum flow through heat-exchange terminals and proceed as specified above for hydronic systems.

3.9 PROCEDURES FOR MOTORS

- A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:
 - 1. Manufacturer, model, and serial numbers.
 - 2. Motor horsepower rating.
 - 3. Motor rpm.
 - 4. Efficiency rating.
 - 5. Nameplate and measured voltage, each phase.
 - 6. Nameplate and measured amperage, each phase.
 - 7. Starter thermal-protection-element rating.

3.10 PROCEDURES FOR TEMPERATURE MEASUREMENTS

- A. During TAB, report the need for adjustment in temperature regulation within the automatic temperature-control system.
- B. Measure indoor wet- and dry-bulb temperatures every other hour for a period of two successive eight-hour days, in each separately controlled zone, to prove correctness of final temperature settings. Measure when the building or zone is occupied.

- C. Measure outdoor-air, wet- and dry-bulb temperatures.

3.11 TEMPERATURE-CONTROL VERIFICATION

- A. Verify that controllers are calibrated and commissioned.
- B. Check transmitter and controller locations and note conditions that would adversely affect control functions.
- C. Record controller settings and note variances between set points and actual measurements.
- D. Check the operation of limiting controllers (i.e., high- and low-temperature controllers).
- E. Check free travel and proper operation of control devices such as damper and valve operators.
- F. Check the sequence of operation of control devices. Note air pressures and device positions and correlate with airflow and water flow measurements. Note the speed of response to input changes.
- G. Check the interaction of electrically operated switch transducers.
- H. Check the interaction of interlock and lockout systems.
- I. Check main control supply-air pressure and observe compressor and dryer operations.
- J. Record voltages of power supply and controller output. Determine whether the system operates on a grounded or nongrounded power supply.
- K. Note operation of electric actuators using spring return for proper fail-safe operations.

3.12 TOLERANCES

- A. Set HVAC system airflow and water flow rates within the following tolerances:
 - 1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus 5 to plus 10 percent.
 - 2. Air Outlets and Inlets: 0 to minus 10 percent.
 - 3. Heating-Water Flow Rate: 0 to minus 10 percent.
 - 4. Cooling-Water Flow Rate: 0 to minus 5 percent.

3.13 REPORTING

- A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions

to HVAC systems and general construction to allow access for performance measuring and balancing devices.

- B. Status Reports: As Work progresses, prepare reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.14 FINAL REPORT

- A. General: Typewritten, or computer printout in letter-quality font, on standard bond paper, in three-ring binder, tabulated and divided into sections by tested and balanced systems.
- B. Include a certification sheet in front of binder signed and sealed by the certified testing and balancing engineer.
 - 1. Include a list of instruments used for procedures, along with proof of calibration.
- C. Final Report Contents: In addition to certified field report data, include the following:
 - 1. Fan curves.
 - 2. Manufacturers' test data.
 - 3. Field test reports prepared by system and equipment installers.
 - 4. Other information relative to equipment performance, but do not include Shop Drawings and Product Data.
- D. General Report Data: In addition to form titles and entries, include the following data in the final report, as applicable:
 - 1. Title page.
 - 2. Name and address of TAB firm.
 - 3. Project name.
 - 4. Project location.
 - 5. Architect's name and address.
 - 6. Engineer's name and address.
 - 7. Contractor's name and address.
 - 8. Report date.
 - 9. Signature of TAB firm who certifies the report.
 - 10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
 - 11. Summary of contents including the following:
 - a. Indicated versus final performance.
 - b. Notable characteristics of systems.
 - c. Description of system operation sequence if it varies from the Contract Documents.
 - 12. Nomenclature sheets for each item of equipment.

13. Data for terminal units, including manufacturer, type size, and fittings.
 14. Notes to explain why certain final data in the body of reports varies from indicated values.
 15. Test conditions for fans performance forms including the following:
 - a. Settings for outside-, return-, and exhaust-air dampers.
 - b. Conditions of filters.
 - c. Cooling coil, wet- and dry-bulb conditions.
 - d. Face and bypass damper settings at coils.
 - e. Fan drive settings including settings and percentage of maximum pitch diameter.
 - f. Other system operating conditions that affect performance.
- E. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:
1. Quantities of outside, supply, return, and exhaust airflows.
 2. Water flow rates.
 3. Duct, outlet, and inlet sizes.
 4. Pipe and valve sizes and locations.
 5. Terminal units.
 6. Balancing stations.
 7. Position of balancing devices.
- F. Fan Test Reports: For supply, return, and exhaust fans, include the following:
1. Fan Data:
 - a. System identification.
 - b. Location.
 - c. Make and type.
 - d. Model number and size.
 - e. Manufacturer's serial number.
 - f. Arrangement and class.
 - g. Sheave make, size in inches (mm), and bore.
 - h. Sheave dimensions, center-to-center, and amount of adjustments in inches (mm).
 2. Motor Data:
 - a. Make and frame type and size.
 - b. Horsepower and rpm.
 - c. Volts, phase, and hertz.
 - d. Full-load amperage and service factor.
 - e. Sheave make, size in inches (mm), and bore.
 - f. Sheave dimensions, center-to-center, and amount of adjustments in inches (mm).
 - g. Number of belts, make, and size.

3. Test Data (Indicated and Actual Values):
 - a. Total airflow rate in cfm (L/s).
 - b. Total system static pressure in inches wg (Pa).
 - c. Fan rpm.
 - d. Discharge static pressure in inches wg (Pa).
 - e. Suction static pressure in inches wg (Pa).
- G. Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:
 1. Report Data:
 - a. System and air-handling unit number.
 - b. Location and zone.
 - c. Traverse air temperature in deg F (deg C).
 - d. Duct static pressure in inches wg (Pa).
 - e. Duct size in inches (mm).
 - f. Duct area in sq. ft. (sq. m).
 - g. Indicated airflow rate in cfm (L/s).
 - h. Indicated velocity in fpm (m/s).
 - i. Actual airflow rate in cfm (L/s).
 - j. Actual average velocity in fpm (m/s).
 - k. Barometric pressure in psig (Pa).
- H. Air-Terminal-Device Reports:
 1. Unit Data:
 - a. System and air-handling unit identification.
 - b. Location and zone.
 - c. Test apparatus used.
 - d. Area served.
 - e. Air-terminal-device make.
 - f. Air-terminal-device number from system diagram.
 - g. Air-terminal-device type and model number.
 - h. Air-terminal-device size.
 - i. Air-terminal-device effective area in sq. ft. (sq. m).
 2. Test Data (Indicated and Actual Values):
 - a. Airflow rate in cfm (L/s).
 - b. Air velocity in fpm (m/s).
 - c. Preliminary airflow rate as needed in cfm (L/s).
 - d. Preliminary velocity as needed in fpm (m/s).
 - e. Final airflow rate in cfm (L/s).
 - f. Final velocity in fpm (m/s).
 - g. Space temperature in deg F (deg C).

- I. System-Coil Reports: For reheat coils and water coils of terminal units, include the following:
 1. Unit Data:
 - a. System and air-handling unit identification.
 - b. Location and zone.
 - c. Room or riser served.
 - d. Coil make and size.
 - e. Flowmeter type.
 2. Test Data (Indicated and Actual Values):
 - a. Airflow rate in cfm (L/s).
 - b. Entering-water temperature in deg F (deg C).
 - c. Leaving-water temperature in deg F (deg C).
 - d. Water pressure drop in feet of head or psig (kPa).
 - e. Entering-air temperature in deg F (deg C).
 - f. Leaving-air temperature in deg F (deg C).

3.15 INSPECTIONS

- A. Initial Inspection:
 1. After testing and balancing are complete, operate each system and randomly check measurements to verify that the system is operating according to the final test and balance readings documented in the Final Report.
 2. Randomly check the following for each system:
 - a. Measure airflow of at least 10 percent of air outlets.
 - b. Measure water flow of at least 5 percent of terminals.
 - c. Measure room temperature at each thermostat/temperature sensor. Compare the reading to the set point.
 - d. Measure sound levels at two locations.
 - e. Measure space pressure of at least 10 percent of locations.
 - f. Verify that balancing devices are marked with final balance position.
 - g. Note deviations to the Contract Documents in the Final Report.
- B. Final Inspection:
 1. After initial inspection is complete and evidence by random checks verifies that testing and balancing are complete and accurately documented in the final report, request that a final inspection be made by Architect.
 2. TAB firm test and balance engineer shall conduct the inspection in the presence of Architect.
 3. Architect shall randomly select measurements documented in the final report to be rechecked. The rechecking shall be limited to either 10 percent of the total

- measurements recorded, or the extent of measurements that can be accomplished in a normal 8-hour business day.
4. If the rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
 5. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.
 6. TAB firm shall recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes and resubmit the final report.
 7. Request a second final inspection. If the second final inspection also fails, Owner shall contract the services of another TAB firm to complete the testing and balancing in accordance with the Contract Documents and deduct the cost of the services from the final payment.

3.16 ADDITIONAL TESTS

- A. Within 90 days of completing TAB, perform additional testing and balancing to verify that balanced conditions are being maintained throughout and to correct unusual conditions.
- B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional testing, inspecting, and adjusting during near-peak summer and winter conditions.

END OF SECTION 15950

SECTION 16050 - BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Electrical equipment coordination and installation.
 - 2. Common electrical installation requirements.

1.3 DEFINITIONS

- A. ATS: Acceptance Testing Specifications.
- B. EPDM: Ethylene-propylene-diene terpolymer rubber.
- C. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.

1.5 QUALITY ASSURANCE

- A. Test Equipment Suitability and Calibration: Comply with NETA ATS, "Suitability of Test Equipment" and "Test Instrument Calibration."

1.6 COORDINATION

- A. Coordinate arrangement, mounting, and support of electrical equipment:
 - 1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
 - 2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
 - 3. To allow right of way for piping and conduit installed at required slope.
 - 4. So connecting raceways and cables will be clear of obstructions and of the working and access space of other equipment.
- B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

- C. Coordinate electrical testing of electrical, mechanical, and architectural items, so equipment and systems that are functionally interdependent are tested to demonstrate successful interoperability.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

- A. Comply with NECA 1.
- B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.
- C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.
- D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.
- E. Right of Way: Give to raceways and piping systems installed at a required slope.

3.2 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 7 Section "Through-Penetration Firestop Systems."

3.3 FIELD QUALITY CONTROL

- A. Inspect installed sleeve and sleeve-seal installations and associated firestopping for damage and faulty work.

END OF SECTION 16050

SECTION 16072 - EQUIPMENT FOUNDATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary conditions and Division 1 Specification Sections, apply to this section.

1.2 SECTION INCLUDES

- A. Equipment foundations (housekeeping pads).

1.3 RELATED SECTIONS

- A. Transformers: Section 16361.
- B. Switchgear: Section 16341.
- C. Switchboards: Section 16441.

1.4 SUBMITTALS

- A. General: Comply with Division 1 and Section 16010.
- B. Product data: Concrete mix, grout, reinforcement, and accessories.
- C. Certifications: Test report showing strength of concrete.

PART 2 - PRODUCTS

2.1 CONCRETE

- A. Concrete: 3,000 psi (20.7 MPa) compressive strength at 28 days.

2.2 GROUT

- A. Non-shrink grout: Premixed, consisting of non-metallic aggregate, cement, water-reducing and plasticizing agents; capable of developing minimum compressive strength of 7,000 psi in 28 days.

Sonneborn-Rexnord "SonogROUT"
L&M Construction Chemical Company "Crystex"
US Grout Corporation "Five-Star Grout"

2.3 METAL REINFORCEMENT

- A. Reinforcing bars: Deformed steel bars in accordance with ASTM A615, Grade 60, clean and free from loose rust, scale, or other coatings that will reduce bond.
- B. Welded wire fabric reinforcing: ASTM A 185 No. 6 steel wire spot-welded at intersections and of size 6 by 6 inch mesh.
- C. Metal accessories: Include spacers, chairs, bolsters, ties, and other devices necessary for properly placing, spacing, supporting and fastening reinforcement in place.

PART 3 - EXECUTION

3.1 INSTALLING EQUIPMENT FOUNDATIONS (HOUSEKEEPING PADS)

- A. Provide 4-inch-high concrete foundations (housekeeping pads) for floor-mounted equipment unless otherwise noted. Furnish foundations, bolts, sleeves, and appurtenances and install as recommended by equipment manufacturer. Anchor the concrete foundations by dowels inserted into the floor slab. Provide welded wire fabric reinforcement.
- B. Unless otherwise specified, install concrete work in accordance with the requirements of Division 3.
- C. Equipment shall be properly aligned. Level and grout equipment where necessary. Support conduit independently of equipment and so as not to cause a strain or thrust.
- D. Coordinate exact locations and configurations of equipment, foundations, and supports with the approved shop drawings of the equipment.

END OF SECTION

SECTION 16075 - ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Identification for raceway.
 - 2. Identification for conductors and communication and control cable.
 - 3. Warning labels and signs.
 - 4. Equipment identification labels.
 - 5. Miscellaneous identification products.

1.3 SUBMITTALS

- A. Comply with Section 01000.
- B. Product Data: For each electrical identification product indicated.
- C. Identification Schedule: An index of nomenclature of electrical equipment and system components used in identification signs and labels.

1.4 QUALITY ASSURANCE

- A. Comply with ANSI A13.1 and ANSI C2.
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.145.

1.5 COORDINATION

- A. Coordinate identification names, abbreviations, colors, and other features with requirements in the Contract Documents, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual, and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.
- B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- C. Coordinate installation of identifying devices with location of access panels and doors.

PART 2 - PRODUCTS

2.1 RACEWAY IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.
- B. Color for Printed Legend:
 - 1. Power Circuits: Black letters on an orange field.
 - 2. Legend: Indicate system or service and voltage, if applicable.
- C. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.
- D. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; 2 inches (50 mm) wide; compounded for outdoor use.

2.2 CONDUCTOR AND COMMUNICATION- AND CONTROL-CABLE IDENTIFICATION MATERIALS

- A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils (0.08 mm) thick by 1 to 2 inches (25 to 50 mm) wide.
- B. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.
- C. Aluminum Wraparound Marker Labels: Cut from 0.014-inch- (0.35-mm)- thick aluminum sheet, with stamped, embossed, or scribed legend, and fitted with tabs and matching slots for permanently securing around wire or cable jacket or around groups of conductors.
- D. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch (50 by 50 by 1.3 mm), with stamped legend, punched for use with self-locking nylon tie fastener.
- E. Write-On Tags: Polyester tag, 0.015 inch (0.38 mm) thick, with corrosion-resistant grommet and polyester or nylon tie for attachment to conductor or cable.
 - 1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.

2.3 WARNING LABELS AND SIGNS

- A. Comply with NFPA 70 and 29 CFR 1910.145.
- B. Self-Adhesive Warning Labels: Factory printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment, unless otherwise indicated.

- C. Baked-Enamel Warning Signs: Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application. 1/4-inch (6.4-mm) grommets in corners for mounting. Nominal size, 7 by 10 inches (180 by 250 mm).
- D. Metal-Backed, Butyrate Warning Signs: Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch (1-mm) galvanized-steel backing; and with colors, legend, and size required for application. 1/4-inch 6.4-mm grommets in corners for mounting. Nominal size, 10 by 14 inches (250 by 360 mm).
- E. Warning label and sign shall include, but are not limited to, the following legends:
 - 1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
 - 2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES (915 MM)."

2.4 EQUIPMENT IDENTIFICATION LABELS

- A. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be 3/8 inch 10 mm.
- B. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. White letters on a dark-gray background. Minimum letter height shall be 3/8 inch 10 mm.
- C. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch (25 mm).

2.5 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Cable Ties: Fungus-inert, self-extinguishing, 1-piece, self-locking, Type 6/6 nylon cable ties.
 - 1. Minimum Width: 3/16 inch (5 mm).
 - 2. Tensile Strength: 50 lb (22.6 kg), minimum.
 - 3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
 - 4. Color: Black, except where used for color-coding.
- B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Raceways and Duct Banks More Than 600 V Concealed within Buildings: 4-inch- (100-mm-) wide black stripes on 10-inch (250-mm) centers over orange background that extends full length of raceway or duct and is 12 inches (300 mm) wide. Stencil legend

"DANGER CONCEALED HIGH VOLTAGE WIRING" with 3-inch- (75-mm-) high black letters on 20-inch (500-mm) centers. Stop stripes at legends. Apply to the following finished surfaces:

1. Floor surface directly above conduits running beneath and within 12 inches (300 mm) of a floor that is in contact with earth or is framed above unexcavated space.
 2. Wall surfaces directly external to raceways concealed within wall.
 3. Accessible surfaces of concrete envelope around raceways.
- B. Accessible Raceways More Than 600 V: Identify with "DANGER-HIGH VOLTAGE" in black letters at least 2 inches (50 mm) high, with self-adhesive vinyl labels. Repeat legend at 10-foot (3-m) maximum intervals.
- C. Accessible Raceways 600 V or Less, for Feeder, and Branch Circuits More Than 30 A: Identify with orange self-adhesive vinyl label .
- D. Accessible Raceways and Cables of Auxiliary Systems: Identify the following systems with color-coded, self-adhesive vinyl tape applied in bands:
1. Electrical Supervisory System: Green and blue.
 2. Control Wiring: Green and red.
- E. Power-Circuit Conductor Identification: For primary and secondary conductors No.1/0 AWG and larger in vaults, pull and junction boxes, manholes, and handholes use aluminum wraparound marker labels. Identify source and circuit number of each set of conductors. For single conductor cables, identify phase in addition to the above.
- F. Branch-Circuit Conductor Identification: Where there are conductors for more than three branch circuits in same junction or pull box, use metal tags. Identify each ungrounded conductor according to source and circuit number.
- G. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source and circuit number.
- H. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, signal, and data connections.
1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
 2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
 3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and Operation and Maintenance Manual.
- I. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Comply with 29 CFR 1910.145 and apply self-adhesive warning labels. Identify system voltage with black letters on an orange background. Apply to exterior of door, cover, or other access.

1. Equipment with Multiple Power or Control Sources: Apply to door or cover of equipment including, but not limited to, the following:
 - a. Controls with external control power connections.
 2. Equipment Requiring Workspace Clearance According to NFPA 70: Unless otherwise indicated, apply to door or cover of equipment but not on flush panelboards and similar equipment in finished spaces.
- J. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.
1. Labeling Instructions:
 - a. Indoor Equipment: Engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high label; where 2 lines of text are required, use labels 2 inches (50 mm) high.
 - b. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
 2. Equipment to Be Labeled:
 - a. Panelboards, electrical cabinets, and enclosures.
 - b. Electrical switchgear and switchboards.
 - c. Transformers.
 - d. Electrical substations.
 - e. Emergency system boxes and enclosures.
 - f. Power-generating units.
 - g. Monitoring and control equipment.

3.2 INSTALLATION

- A. Verify identity of each item before installing identification products.
- B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- C. Apply identification devices to surfaces that require finish after completing finish work.
- D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

- E. Attach nonadhesive signs and plastic labels with screws and auxiliary hardware appropriate to the location and substrate.
- F. System Identification Color Banding for Raceways and Cables: Each color band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25-foot (7.6-m) maximum intervals in congested areas.
- G. Color-Coding for Phase and Voltage Level Identification, 600 V and Less: Use the colors listed below for ungrounded service, feeder, and branch-circuit conductors.
 - 1. Color shall be factory applied or, for sizes larger than No. 10 AWG if authorities having jurisdiction permit, field applied.
 - 2. Colors for 208/120-V Circuits:
 - a. Phase A: Black.
 - b. Phase B: Red.
 - c. Phase C: Blue.
 - 3. Colors for 480/277-V Circuits:
 - a. Phase A: Brown.
 - b. Phase B: Orange.
 - c. Phase C: Yellow.
 - 4. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches (150 mm) from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.
- H. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.

END OF SECTION 16075

SECTION 16120 - CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes building wires and cables and associated connectors, splices, and terminations for wiring systems rated 600 V and less.
- B. Related Sections include the following:
 - 1. Division 16 Section "Medium-Voltage Cables" for single-conductor and multiconductor cables, cable splices, and terminations for electrical distribution systems with 2001 to 35,000 V.

1.3 SUBMITTALS

- A. Comply with Section 01000.
- B. Product Data: For each type of product indicated.
- C. Field Quality-Control Test Reports.

1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

- A. Refer to Part 3 "Conductor and Insulation Applications" Article for insulation type, cable construction, and ratings.
- B. Conductor Material: Copper complying with NEMA WC 5 or 7; solid conductor for No. 10 AWG and smaller, stranded for No. 8 AWG and larger.
- C. Conductor Insulation Types: Type THHN-THWN complying with NEMA WC 5 or 7.

2.2 CONNECTORS AND SPLICES

- A. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

PART 3 - EXECUTION

3.1 CONDUCTOR AND INSULATION APPLICATIONS

- A. Exposed Feeders: Type THHN-THWN, single conductors in raceway.
- B. Class 1 Control Circuits: Type THHN-THWN, in raceway.
- C. Class 2 Control Circuits: Type THHN-THWN, in raceway.

3.2 INSTALLATION

- A. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- B. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- C. Install all conductors in raceways.
- D. Identify and color-code conductors and cables according to Division 16 Section "Electrical Identification."

3.3 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

3.4 FIELD QUALITY CONTROL

- A. Testing: Perform the following field quality-control testing:
 - 1. After installing conductors and cables and before electrical circuitry has been energized, test for compliance with requirements.
 - 2. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.3.1. Certify compliance with test parameters.
- B. Test Reports: Prepare a written report to record the following:

1. Test procedures used.
2. Test results that comply with requirements.
3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

END OF SECTION 16120

SECTION 16124 - MEDIUM-VOLTAGE CABLES

PART 1 - GENERAL

1.1 SUMMARY

- A. Medium-voltage cable systems,.

1.2 RELATED SECTIONS

- A. Raceways and boxes: Section 16130.
- B. Apparatus, inspection, and testing: Section 16950.

1.3 REFERENCES

- A. ASTM B 8: Concentric-lay Stranded Copper Conductors, Hard, Medium-hard, and Soft.
- B. IEEE Std. 48: Standard Test Procedures and Requirements for Alternating-Current Cable Terminations 2.5 Kv through 765 Kv.
- C. IEEE Std. 404: Cable Joints for Use with Extruded Dielectric Cable Rated 5000 V through 138 000 V and Cable Joints for Use with Laminated Dielectric Cable Rated 2500 V through 5000 000V.
- D. NEMA WC 24: Standard for Shielded Power Cables Rated 5001 46 kV for Use in the Distribution of Electrical Energy.
- E. UL 1072: Medium Voltage Power Cables.
- F. AEIC CS 8-2000: Specification for Extruded Dielectric Shielded Power Cable Rated 5-46 kV.

1.4 SUBMITTALS

- A. Comply with Section 01000.
- B. Product data:
 - 1. Each type of wire and cable, including accessories.
 - 2. Termination and joint kits, including manufacturer's instructions.
 - 3. Fire protection materials, including manufacturer's application instructions.
- C. Certifications:

1. Qualification of cable splicers, accompanied by documentation of the training and experience of each person recommended to install cables.
 2. Cable manufacturer's approval of medium-voltage termination and joint kits.
 3. Manufacturer's certified test report for cable (15 kv), including warranted values of physical and electrical characteristics.
- D. Qualification Data: For testing agency.
- E. Field test reports: Each test required in Part 3 below of cables rated above 600 volts.

1.5 QUALITY ASSURANCE

- A. Qualifications of cable splicers: Persons recommended to perform the splicing and termination of medium-voltage cables shall have been adequately trained in the proper techniques and have had at least 3 recent years of experience in splicing and terminating medium-voltage cables.
- B. In addition, cable splicers may be required to perform a dummy or practice splice and termination, in the presence of the Government, before being approved as a qualified installer of cables. If that additional requirement is imposed, provide short sections of the approved types of cables along with the approved type of splice and termination kits, and detailed manufacturer's instruction for the proper splicing and termination of the approved cable types.
- C. Medium-voltage cable shall have the date of manufacture and other identification printed on its outer surface at regular intervals for its entire length.
1. Cables manufactured more than 12 months before the date of delivery will not be accepted.
- D. Testing agency qualifications: Independent testing agency shall meet OSHA criteria for accreditation of testing laboratories, Title 29, Part 1907, or shall be a full member company of the InterNational Electrical Testing Association.
1. Testing agency's field supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies, to supervise on-site testing specified in Part 3.

PART 2 - PRODUCTS

2.1 WIRING ACCESSORIES

- A. Fireproofing tape: Tape composed of a flexible, conformable, unsupported, intumescent elastomer.
1. Thickness: Not less than 0.3 inch (0.762 mm).

2. Properties: Noncorrosive to cable sheath, self-extinguishing, noncombustible, and shall not deteriorate when exposed to oil, water, gases, salt water, sewage, or fungus.

2.2 CABLE (15 KV)

- A. Cable shall have been manufactured no more than 12 months before the date of delivery, as required in "Quality Assurance" in Part 1 above.
- B. Do not ship cable for the project until the certified test report has been approved.
- C. Cable shall have 3 single copper conductors, compact, round, stranded, meeting requirements of ICEA S-68-516, NEMA WC 8, and UL 1072, and shall be rated 15,000 volts, 90 degrees C continuous operating temperature, and 100 percent insulation level.
- D. Materials:
 1. Around the conductor: Extruded, semiconducting or nonconducting, thermosetting or thermoplastic material.
 2. Insulation: Ozone-resistant or ozone-proof, ethylene-propylene rubber, Class III or Class IV in accordance with ICEA S-94-649.
 3. Over the insulation: Extruded, semiconducting, thermosetting or thermoplastic material.
 4. Shield: Concentric, one-third neutral, made of helically wound copper wires.
 5. Jacket: Oil- and sunlight-resistant polyethylene, extruded.

2.3 MEDIUM-VOLTAGE CABLE TERMINATIONS

- A. IEEE Std 48 Class 1, manufactured termination kits including stress control terminator, ground clamp, connectors, and lugs; suitable for the type and materials of the cable terminated.
- B. Copper parts in contact with aluminum parts are not permitted.
- C. Heat-shrinkable type: Uniform cross-section, heat-shrinkable polymer stress relief tubing and environmentally sealed outer covering, nontracking and resistant to atmospheric contaminants, ultraviolet rays, and oxidation.
 1. Include heat-shrinkable shed or skirts of the same material.

2.4 MEDIUM-VOLTAGE CABLE JOINTS (SPLICE KITS)

- A. IEEE Std 404, manufactured splice kits suitable for the rated voltage, insulation level, and insulation type of the cable, rated for no less than 35 kV.
- B. Connectors: Tin-plated electrolytic copper, with tapered ends and center stops.

- C. Heat-shrinkable type: Uniform cross-section, heat-shrinkable polymer with linear stress-relief system, high-dielectric-strength insulating material, and an integrally bonded outer conductor layer (shield).
- D. Replace original cable jacket with a heavy-wall, heat-shrinkable sleeve with waterproof mastic seal on each end.

2.5 SOURCE QUALITY CONTROL

- A. Factory test cable and submit certified test report for approval. Do not ship cable until report has been approved.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Provide wiring indicated in accordance with national, state, and local electric codes.

3.2 INSTALLING MEDIUM-VOLTAGE CABLE

- A. Install medium-voltage conductors between switchgear in rigid, heavy-wall (RGS) galvanized steel conduit or in concrete encased duct banks.
- B. Make cable terminations at switchgear with specified termination kits.
- C. Fire wrap each individual cable where exposed in manhole. Extend fireproofing no less than one inch (25 mm) into ducts. Follow manufacturer's written instructions; ensure that installation complies with requirements for the system rating.
- D. Each cable run shall be installed as one continuous cable with minimal splices.

3.3 SPLICING AND TESTING MEDIUM-VOLTAGE CABLE (RATED ABOVE 600 V)

- A. Splices: Suitable for continuous immersion in water and shall be made only in accessible locations in manholes.
- B. Kit methods: Medium-voltage splices shall be made using specified joint kits. Do not start medium-voltage splicing until manufacturer's instructions have been approved.
- C. Visual and mechanical inspection:
 - 1. Inspect exposed cable sections for physical damage.
 - 2. Verify that cable is supplied and connected in accordance with contract documents.
 - 3. Inspect for proper shield grounding, cable support, and cable termination.
 - 4. Verify that cable bends are not less than ICEA or manufacturer's minimum allowable bending radius.
 - 5. Inspect for proper fireproofing.

6. Visually inspect jacket and insulation condition.
 7. Inspect for proper phase identification and arrangement.
- D. Testing: After installation, and before placing in service, perform a dc high-potential test on electrical cables rated above 600 V. Adhere to precautions and limits specified in the applicable standards. Current-sensing circuits in test equipment shall measure only the leakage current associated with the cable under test, and shall not include internal leakage current of the test equipment. Follow test procedures below. Record the results of each cable test and submit as required in Part 1 above.
1. Record temperature and relative humidity. Do not perform tests unless weather is clear and relative humidity is below 70 percent.
 2. Each conductor shall be individually tested with all other conductors grounded. All shields shall be grounded.
 3. Terminations shall be properly corona suppressed by guard ring, field reduction sphere, or other suitable methods.
 4. Perform megger and continuity test prior to high-potential test.
 5. A dc high potential shall be applied in at least five equal increments until maximum test voltage is reached. Record dc leakage current at each step after a constant stabilization time consistent with system charging current decay. 100 percent voltage shall be reached in a maximum of 60 seconds.
 6. Make a graphic plot of leakage current (X axis) versus voltage (Y axis) at each increment.
 7. Raise the test conductor to a maximum test voltage and hold for a total of 15 minutes. Record and plot readings of leakage current (Y axis) versus time (X axis).
 8. The conductor test potential shall be reduced to zero and grounds applied for at least ten minutes.
 9. The dc test voltages shall be 55 kV.
- E. Testing agency: Engage a qualified independent testing agency to perform the testing.

END OF SECTION

SECTION 16130 - RACEWAYS AND BOXES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.
- B. Related Sections include the following:
 - 1. Division 7 Section "Through-Penetration Firestop Systems" for firestopping materials and installation at penetrations through walls, ceilings, and other fire-rated elements.
 - 2. Division 16 Section "Basic Electrical Materials and Methods" for supports and anchors.

1.3 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. RGS: Rigid galvanized steel.
- C. FMC: Flexible metal conduit.
- D. IMC: Intermediate metal conduit.
- E. LFMC: Liquidtight flexible metal conduit.
- F. RNC: Rigid nonmetallic conduit.

1.4 SUBMITTALS

- A. Comply with Section 01000.
- B. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
- C. Shop Drawings: Show fabrication and installation details of components for raceways, fittings, boxes, enclosures, and cabinets.

1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.

1.6 COORDINATION

- A. Coordinate layout and installation of raceways, boxes, enclosures, cabinets, and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND TUBING

- A. Rigid Steel Conduit: ANSI C80.1.
- B. IMC: ANSI C80.6.
- C. RNC: NEMA TC2, Type EPC-40-PVC.
- D. Fittings for RNC: NEMA TC-3 to match conduit type and material.
- E. EMT and Fittings: ANSI C80.3.
 - 1. Fittings: Compression type.
- F. FMC: Zinc-coated steel.
- G. LFMC: Flexible steel conduit with PVC jacket.
- H. Fittings: NEMA FB 1; compatible with conduit and tubing materials.

2.2 BOXES, ENCLOSURES, AND CABINETS

- A. Sheet Metal Outlet and Device Boxes: NEMA OS 1.
- B. Cast-Metal Outlet and Device Boxes: NEMA FB 1, Type FD, with gasketed cover.
- C. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- D. Cast-Metal Pull and Junction Boxes: NEMA FB 1, cast aluminum with gasketed cover.
- E. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous hinge cover and flush latch.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
- F. Cabinets: NEMA 250, Type 1, galvanized steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel. Hinged door in front cover with flush latch and concealed hinge. Key latch to match panelboards. Include metal barriers to separate wiring of different systems and voltage and include accessory feet where required for freestanding equipment.

2.3 FACTORY FINISHES

- A. Finish: For raceway, enclosure, or cabinet components, provide manufacturer's standard prime-coat finish ready for field painting.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

- A. Outdoors:
 1. Exposed: Rigid steel or IMC.
 2. Concealed: Rigid steel or IMC.
 3. Underground, Single Run: RNC or RGS where noted.
 4. Underground, Grouped: RNC.
 5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
 6. Boxes and Enclosures: NEMA 250, Type 4, stainless steel.
- B. Indoors:
 1. Exposed: EMT (below 2 inches), IMC or RGS (2 inches and above)
 2. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC; except use LFMC in damp or wet locations.
 3. Damp or Wet Locations: Rigid steel conduit.
 4. Boxes and Enclosures: NEMA 250, Type 1, except as follows:
 - a. Damp or Wet Locations: NEMA 250, Type 4, stainless steel.
 5. For 15 kV cables: RGS
- C. Minimum Raceway Size: 3/4-inch trade size (DN 21).
- D. Raceway Fittings: Compatible with raceways and suitable for use and location.
 1. Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.

3.2 INSTALLATION

- A. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- B. Complete raceway installation before starting conductor installation.
- C. Support raceways as specified in Division 16 Section "Electrical Supports and Seismic Restraints."
- D. Install temporary closures to prevent foreign matter from entering raceways.
- E. Protect stub-ups from damage where conduits rise through floor slabs. Arrange so curved portions of bends are not visible above the finished slab.
- F. Make bends and offsets so ID is not reduced. Keep legs of bends in the same plane and keep straight legs of offsets parallel, unless otherwise indicated.
- G. Install exposed raceways parallel or at right angles to nearby surfaces or structural members and follow surface contours as much as possible.
 - 1. Run parallel or banked raceways together on common supports.
 - 2. Make parallel bends in parallel or banked runs. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for parallel raceways.
- H. Join raceways with fittings designed and approved for that purpose and make joints tight.
- I. Terminations:
 - 1. Where raceways are terminated with locknuts and bushings, align raceways to enter squarely and install locknuts with dished part against box. Use two locknuts, one inside and one outside box.
 - 2. Where raceways are terminated with threaded hubs, screw raceways or fittings tightly into hub so end bears against wire protection shoulder. Where chase nipples are used, align raceways so coupling is square to box; tighten chase nipple so no threads are exposed.
- J. Stub-up Connections: Extend conduits through concrete floor for connection to equipment. Extend conductors to equipment with rigid steel conduit.
- K. Flexible Connections: Use maximum of 72 inches (1830 mm) for equipment subject to vibration, noise transmission, or movement; and for all motors. Use LFMC in damp or wet locations. Install separate ground conductor across flexible connections.
- L. Install hinged-cover enclosures and cabinets plumb. Support at each corner.

3.3 PROTECTION

- A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.
 - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.4 CLEANING

- A. After completing installation of exposed, factory-finished raceways and boxes, inspect exposed finishes and repair damaged finishes.

END OF SECTION 16130

SECTION 16231 - GENERATORS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Standby engine generators matching existing generators.

1.2 RELATED SECTIONS

- A. Fuel oil piping: Section 15191.
- B. Generator exhaust piping: Section 15229.
- C. Apparatus inspection, and testing: Section 16950.

1.3 REFERENCES

- A. ANSI/IEEE C37.04 and .06 - Standard ratings and preferred ratings for Indoor AC Medium-Voltage Circuit Breakers used in Metal-Clad Switchgear.
- B. ANSI/IEEE C37.11 - Requirements for electrical control for AC High-Voltage Circuit Breakers rated on a symmetrical current basis or a total current basis.
- C. ANSI/IEEE C37.09 - Standard Design and Production Testing.
- D. ANSI Z55.1 - Gray Finishes for Industrial Apparatus and Equipment.
- E. ANSI/IEEE C57.13 - Requirements for Instrument Transformers.
- F. IEEE Std 32: Requirements, Terminology and Test Procedure for Neutral Grounding Devices.
- G. NEMA SG4 - Alternating Current High Voltage Circuit Breakers.
- H. NEMA SG5 - Power Switchgear
- I. 40 CFR 89 -Control of Emissions from New and In-Use Nonroad Compression-Ignition Engines.

1.4 SUBMITTALS

- A. General: Comply with Section 01000.
- B. Product data: Submit the following performance data and guarantees pertaining to the engine generator, paralleling equipment, and to the auxiliary equipment proposed to be furnished:

1. General data:
 - a. Make and model of engine and engine specifications.
 - b. Make and model of generator and generator specifications.
 2. Day tank.
 3. Vibration isolators
 4. Control batteries and charger
 5. Engine batteries and charger.
 6. Silencer and catalytic converter.
- C. Shop drawings: As soon as practicable, after notice to proceed and before commencement of placement of orders for materials and equipment, submit shop drawings listed below:
1. Generators:
 - a. Certified outline, general arrangement (setting plan), and anchor bolt details. Drawings shall show the total weight and center of gravity of the assembled equipment on mounting skid.
 - b. General arrangement and detail piping of exhaust and air intake piping systems.
 - c. Dimensional drawings of exhaust silencers.
 - d. General arrangement drawings of the Generator Room showing locations of the generator, and all auxiliary equipment in relation to the diesel generating unit. Drawing scale shall be 1/4-inch equals 1 foot or larger.
 - e. Piping schematics for fuel oil, lubricating oil, jacket water, and cooling water.
- D. Factory tests and inspections: Provide certified copies of manufacturer's test data and results of tests specified in Part 2, within 14 days after completion of tests.
- E. Independent testing company certification required in "Quality Assurance."
- F. Permit to Construct/Operate Internal Combustion Engine, obtained from District of Columbia Air Quality Division.
- G. Tools, testing equipment, and spare parts: Submit a recommended list for each item of equipment. List all special tools and wrenches required for erection, maintenance, and operation of the equipment. Include part number, drawing number, and source of supply.
- H. Manuals: Provide operation and maintenance manuals for equipment as listed, including identification symbols for each replaceable part and assembly. Information in manuals shall be comprehensive and specific. Provide manuals for all components including the following equipment:
1. Diesel-electric generating units and associated equipment, including fuel adjustment procedure and maximum tolerances of wear on bearings and other rubbing surfaces that will require corrective measures.

2. Day tank.

1.5 QUALITY ASSURANCE

- A. Generator installation shall comply with NFPA 110, Emergency and Standby Power Systems, and with NFPA 37, Standard for the Installation of Stationary Combustion Engines and Gas Turbines.
- B. The system shall be built, tested and shipped by the manufacturer of the alternator so there is one source of supply and responsibility. Performance of the electric plant for this project shall be certified by an independent testing laboratory as to the plant's full power rating, stability, voltage and frequency regulation.
- C. Testing Agency Qualifications: In addition to the quality control requirements specified in Division 1, an independent testing agency shall meet OSHA criteria for accreditation of testing laboratories, title 29, Part 1907, or shall be a full member company of the InterNational Electrical Testing Association.
 1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies, to supervise on-site testing specified in Part 3.
- D. Engine exhaust emissions: Meet the requirements of the District of Columbia Air Quality Division, and 40 CFR 89.

1.6 QUALIFICATIONS OF SERVICE AND MAINTENANCE AGENCY

- A. Located in the Washington, DC, metropolitan area within a 50 mile radius of the project.
- B. Staff of factory-trained engineers.
- C. Maintains an adequate stock of manufacturer's genuine or approved parts to service this equipment.
- D. Has service contracts available.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Make field measurements to determine how generator will be disassembled and delivered to the Generator Room. Ensure that parts can be delivered, handled, and reassembled in the designated spaces.
- B. After factory test, disassemble generator as required to install in the Generator Room. Installation access shall be via the truck tunnel to the Generator Room.

1.8 WARRANTY

- A. General warranty: Special warranty specified in this Article shall not deprive the Government of other rights the Government may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Special warranty: Written warranty, executed by manufacturer agreeing to repair or replace packaged engine generator and auxiliary components that fail in materials or workmanship within specified warranty period.
 - 1. Warranty period: Five years from date of acceptance.
 - 2. Warranty shall include all parts and labor for the warranty period.

PART 2 - PRODUCTS

2.1 DIESEL-ELECTRIC GENERATING UNIT

- A. General: The generating unit shall consist of a diesel engine direct-connected to an ac generator with brushless excitation system and accessories and auxiliary equipment resulting in complete self-contained unit.
- B. Equipment rating and capability: Provide Caterpillar 3516B with Caterpillar SR-4BHV generator diesel-electric generating unit to match existing units with the standby rating capacity of 2000 kW at 0.8 power factor, 13.2 kV, 3 Phase, 3 Wire.
- C. Mounting base: Factory-mount diesel generating unit and its auxiliaries, except the day tank and exhaust silencer, on a common base fabricated of structural steel sections. The structural base shall be of the heavy duty skid type and shall have adequate strength and rigidity to maintain alignment of the equipment without a concrete foundation. Field-erect exhaust silencer as required. Piping to make a complete installation shall be provided as specified in Division 15. Steel used in fabrication of the mounting base shall be free from sharp bends and corners. Provide base and components with suitable lifting attachments. Locate attachments so that when the slings and lifting cables are attached, they will not harm exterior parts of the equipment.
- D. Performance:
 - 1. Voltage regulation shall be plus or minus 0.5 percent for any constant load between no load and rated load for both parallel and nonparallel applications. Random voltage variation with any steady load from no load to full load shall not exceed plus or minus 0.5 percent.
 - 2. The generator set shall share real and reactive load proportionally within plus or minus 5 percent with all other generator sets in the system.
 - 3. Frequency regulation shall be isochronous from steady state no load to steady state rated load. Random frequency variation with any steady load from no load to full load shall not exceed plus or minus 0.25 percent.
 - 4. The diesel engine-generator set shall be capable of single step load pick up of 100 percent nameplate kW and power factor, less applicable derating factors, with the engine-generator set at operating temperature.

5. Motor starting capability shall be a minimum of 9000 kVA. The generator set shall be capable of sustaining a minimum of 90 percent of rated no load voltage with the specified kVA load at near zero power factor applied to the generator set.
6. Pitch: 0.6667
7. Poles: 4
8. Overspeed capability: 125 percent
9. Harmonic Distortion: Less than 5 percent
10. Wave form: Less than 5 percent deviation

2.2 DIESEL ENGINES

- A. Engines: 4-cycle turbo-supercharged, vertical V type, designed and constructed to eliminate undue heating, vibration, and wear, capable of burning diesel fuel oil Grade DF-2 and shall comply with EPA 40 CFR 89 Tier 1 emission limits.
 1. Maximum engine speed: 1800 rpm.
 2. Maximum piston speed: 2250 fpm.
- B. General construction: Construct engine to allow easy access to various parts for maintenance purposes. Enclose parts to prevent throwing or dripping oil. Provide removable shells with main bearings and connecting rod bearings. Provide crankshaft with rigid or flexible coupling for connection to the flywheel and generator.
- C. Turbocharger: Turbine-type driven by exhaust gas from engine cylinders, and direct-connected to blower supplying air to the engine intake manifold, pressure-lubricated. Provide all necessary supports and connections.
- D. Engine lubricating oil system: Arranged to distribute oil to all moving parts of the engine. Provide positive displacement pump, pressure regulating valves, oil filter, oil level indicator, crankcase ventilator if design requires, and the necessary piping and fittings. Provide all necessary stop, check, pressure relief, and pressure control valves. Maintain temperature of lubricating oil entering the engine distribution system at the optimum value recommended by the engine manufacturer for the best engine life with the engine operating continuously at any load within the engine rating and under the conditions specified herein. System shall include the major items of equipment listed below, mounted on the engine or on the mounting base. Provide all equipment, complete with stop valves, check valves, and pressure and temperature control valves as required for a complete system, included and pre-piped as an integral system prior to shipment. Blank off connections for external piping with wood blind flanges or plugs.
 1. Lubricating oil circulating pump: Positive displacement oil circulating pump driven from the engine crankshaft or camshaft, with ample capacity to circulate the amount of lubricating oil and cooling oil required by the engine. Equip pump with a bypass relief valve.
 2. Lubricating oil filtration: Full flow bypass filters with replaceable spin-on canister elements and full flow strainer. Provide filter capable of passing the full flow engine circulating rate and removing not less than 90 percent of the particles 5 microns and larger. Provide two spare sets of replacement elements for each filter.

3. Lubricating oil cooler: Ample capacity to remove the total amount of heat rejected to the lubricating oil from the engine at 110 percent rated full load. Cooler shall limit the temperature of the lubricating oil in the sump to the optimum temperature recommended by the engine manufacturer.
 4. Thermostatic control valve: Valve in the lubricating oil system shall maintain a constant lubricating oil temperature to the engine. Provide valve capable of passing the total lubricating oil flow requirement of the engine, as determined by the engine manufacturer. Provide valve with one or more interchangeable thermostatic elements. Provide nonadjustable type thermostat factory-set at the temperature recommended by the engine manufacturer. Design valve to fail-safe, permitting oil flow through the engine.
- E. Engine fuel oil system: Conform to NFPA 30 and NFPA 37 and the requirements herein. Employ a mechanical fuel injection system using a common rail system or an individual pump system. Provide injection pumps as an integral part of the engine and driven by the engine camshaft. Provide suitable adjustments for timing and for balancing of cylinder pressures. Provide the following items:
1. A built-on positive displacement fuel oil supply pump driven from the engine crankshaft or camshaft. Pump capacity shall suit engine requirements under the maximum load condition.
 2. A suitable positive displacement fuel oil priming pump for priming the fuel system, if required, to assure quick starting, and arranged to operate with the automatic starting system.
 3. Fuel oil filters in the piping ahead of the injection pumps. Provide generator unit with a parallel filter arrangement having built-in changeover valves allowing either filter to be used independently. Filters shall have replaceable spin-on canister elements. In addition to the filters, provide water separators in each fuel line.
 4. Day tank: Freestanding, factory-fabricated assembly of a fuel tank listed by a nationally recognized testing laboratory, with integral float-controlled transfer pumps and the following features:
 - a. Containment: Integral rupture basin with a capacity of 150 percent of nominal capacity of day tank.
 - b. Leak detector: Locate in rupture basin and connect to provide audible and visual alarm in the event of day-tank leak.
 - c. Pumps: Duplex supply lead-lag pumps and single return pump. Include level controls in tank for operation of pumps. Provide a hand-operated pumps for emergency use.
 - d. Unit, including alarm contacts: Complies with UL 1242.
 - e. Low-level alarm sensor: Separate device operates alarm contacts at 75 percent of normal fuel level.
 - f. High-level alarm sensor: Separate device operates alarm and redundant fuel shutoff contacts at 106 percent of normal fuel level.
 - g. Piping connections: Include fuel suction and return lines to fuel storage tank; fuel supply; and return lines to engine, local fuel fill, vent line, overflow line, and tank drain complete with shutoff valve.

- h. Redundant high-level fuel auto-off-manual switch: Actuated by high-level alarm sensor in day tank. It operates a separate motor device that disconnects day-tank pump motor. It also closes a solenoid valve in fuel suction line from fuel storage tank to day tank. Both items remain in shutoff state until manually reset. Shutoff action initiates an alarm signal to control panel but does not shut down engine generator set.
 - i. Alarm horn shall sound when leak, low-level, or high-level alarm sensors are activated.
 - j. Remote alarm horn: Ratings compatible with the output voltage supplied from the day tank controller.
 - (1) Operation: From dry contacts in the day tank controller, activated by overflow and low fuel level conditions.
 - (2) Surface-mounted in location indicated.
 - (3) The fuel day tank control shall be provided with On/Off/Emergency run switch, Test/Reset switch, ac circuit breaker, dc circuit breaker, and indicator lamps.
 - (4) Ready (green) - ac supply and dc control power available.
 - (5) High Fuel (red) - Latching fault, indicates fuel level near overflow, shuts down pump, and closes N/O dry contacts.
 - (6) Low Fuel (red) - Latching fault, indicates pump failure or operating float switch failure, Closes N/O dry contacts.
 - (7) Low Fuel Shutdown (red) - Latching fault, indicates near empty tank, closes N/O contacts which may be used to shutdown generator set to avoid air in the injection system.
 - (8) Overflow to basin (red) - Latching fault, indicates fuel in overflow/rupture basin, shuts down pump, closes N/O dry contacts.
 - (9) Pump Running (green)
 - (10) Contacts shall be rated not less than 2 amps at 30VDC and 0.5 amps at 120VAC
5. Engine radiator-mounted fuel oil cooler.
- F. Engine starting system: Type which will enable instantaneous starting of the diesel engine with ambient temperatures between zero degrees and 100 degrees F. Arrange system to automatically start the engine and be integrated in sequence with the automatic controls.
- 1. Electric starting system shall use 24-volt DC electric circuit, with negative polarity grounded, energized by storage batteries. Cranking motors shall be heavy-duty type with adequate capacity to crank the engine repeatedly to start within 5 minutes in the ambient temperature range specified above. Design drive mechanism for engaging the starting motor with the engine flywheel to inherently engage and release without binding.
 - 2. Engine starting batteries: Adequate to supply the engine starting system. Provide heavy-duty industrial type nickel-cadmium batteries. Battery shall have a voltage rating to match the voltage of the starting system. Provide voltage and ampere-hour rating of the battery sufficient to provide not less than two minutes of cranking at

- zero degree F. while retaining a battery voltage of 1.0 volt or more per cell. Specific gravity shall not exceed 1.250.
3. Battery charger: For engine starting battery, enclosed, pedestal-mounted, constant-voltage, current limited, heavy-duty, industrial type charger designed for operation from a 120 volts, single-phase, 60-Hz, AC supply, suitable for keeping the diesel engine starting batteries in a charged condition during periods when the engine is idle. Output shall be automatically and continuously adjusted by a solid state voltage regulator, depending on state of charge of battery.
- G. Voltmeter and ammeter to show charger output.
- H. 0 to 24 hour range timer for equalizing charges. When timer is manually turned on, automatically adjust charger output to 2.33 volts per cell. When timer runs out, automatically restore charger output to normal floating voltage.
- I. Alarm indication and individual Form C contacts for indication of "Loss of AC Power," "Low Battery Voltage," "High Battery Voltage," and "Power On."
- J. Coolant heater: Engine-mounted, thermostatically controlled, two minimum 6000 watt coolant heater(s) for each engine. Heater voltage shall be 480 volts, single phase.
1. The coolant heater shall be installed on the engine with silicone hose connections. Steel tubing shall be used for connections into the engine coolant system wherever the length of pipe run exceeds 12 inches. The coolant heater installation shall be specifically designed to provide proper venting of the system. The coolant heaters shall be installed using quick disconnect couplers to isolate the heater for replacement of the heater element. The quick disconnect/automatic sealing couplers shall allow the heater element to be replaced without draining the engine cooling system or significant coolant loss.
 2. The coolant heater shall be provided with a 24Vdc thermostat, installed at the engine thermostat housing. An ac power connection box shall be provided for a single ac power connection to the coolant heater system.
 3. The coolant heater(s) shall be sized as recommended by the engine manufacturer to warm the engine to a minimum of 100 degrees F (40 degrees C) in a 40 degrees F ambient, in compliance with NFPA 110 requirements.
- K. Engine cooling system: Closed, with primary and secondary circuits, including an engine-driven jacket water pump, skid-mounted radiator.
1. Centrifugal jacket water pump: Built on the engine and driven from the engine crankshaft or camshaft, ample capacity to circulate the required flow of engine jacket water through the radiator to remove the total heat rejected from the engine to the jacket water and lubricating oil at 110 percent rated load in 110 degrees F ambient while maintaining the optimum jacket water temperature leaving and entering the engine recommended by the engine manufacturer.
 2. Thermostatic control valve: Shall maintain constant water temperature to the engine. Provide modulating type thermostatic valves using self-contained thermostats without external bulbs. Provide valves with one or more

interchangeable thermostatic elements. Provide nonadjustable type thermostat with operating temperature factory-set at the temperature recommended by the engine manufacturer. Design valve so that in event of thermostatic element failure it will fail-safe, permitting water flow through the engine.

- L. Governor system: Provide diesel-electric generator set with a speed governor system and overspeed limit shutdown device. Speed governing system shall conform to IEEE 126, Sections I and III, except as modified herein. Provide an adjustable isochronous governor, with speed sensing. Governor shall include provisions for adjusting voltage droop, load limit, and speed while unit is in operation. Governor characteristics shall conform to the following:
1. Minimum range of speed changer (expressed as a percent of rated speed): -15 to +5.
 2. Observed speed band shall not exceed (expressed as a percent deviation of rated speed): plus or minus 0.25.
 3. The governor shall maintain governed speed at 60 Hertz at any load from no load to full load.
 4. Minimum manual speed regulation range adjustment (expressed as percent of rated speed): 0 to 5.
 5. Governor shall be suitable for digital paralleling with the existing three generator sets.
- M. Engine protective devices: Provide engine with protective devices as follows:
1. Shutdown devices shall shut down engine by shutting off the fuel supply to the engine. Provide positive shutdown devices direct in action and independent of the governor. Shutdown devices shall also actuate a shutdown relay which shall disable the engine starting circuit until manually reset. Provide shutdown devices with fixed set points equipped with auxiliary electrical contacts which close when the device operates, and auxiliary contacts rated for the operating voltage of the generator main circuit breaker control. Provide the following shutdown devices:
 - a. Overspeed device which operates if engine speed exceeds normal synchronous speed by 10 percent. Device shall require manual reset.
 - b. Pressure switch which operates if lubricating oil pressure drops below a preset value.
 - c. Temperature switch which operates if jacket water temperature exceeds a preset value.
 - d. Other shutdown devices recommended by the engine manufacturer.
- N. Engine alarm contact devices: Equip engine with alarm devices, relays, and auxiliary contacts, as required, to actuate alarm system on the generator switchboard panel. Provide alarm devices with fixed set points. Provide the following alarm contact devices:
1. Pressure switch in engine lubricating oil system piping from engine which shall operate if pressure drops below a preset value.

2. Temperature switch in the jacket water discharge piping from the engine which shall operate if the temperature exceeds a preset value.
 3. Temperature switch in lubricating oil piping manifold leaving the engine which shall operate if temperature exceeds a preset value.
 4. Other alarm devices recommended by the manufacturer.
- O. Engine accessories:
1. Anchor bolts, nuts and vibration isolators for mounting the generating unit mounting skid to a concrete sub-base. Vibration isolators shall be the steel spring type, maximum deflection 1 inch, size and quantity as recommended by the manufacturer.
 2. Exhaust manifold.
 3. Air intake manifold.
 4. All necessary piping normally attached to the engine, including flexible connection to fuel oil piping and piping between engine and day tank.
- P. Air intake and exhaust systems: Include piping, fittings, and expansion joints necessary to interconnect equipment with the engine.
1. Provide dry type air intake filter, capable of removing dirt and abrasives from intake air to the degree of cleanliness required by the engine. Size filter to suit engine requirements at 110 percent of rated full load. Design unit to permit easy access to the filter for maintenance purposes. Provide connection on the engine suitable for engine-mounted filter.
 2. Provide a Critical/Hospital Grade silencer and catalytic converter with the capability to attenuate engine exhaust sound at a rate to meet the sound frequency attenuation levels specified below:

Required Sound	63 Hertz :	24 Dba
	125 Hertz :	32 Dba
	2000 Hertz :	37 Dba
	250 Hertz :	40 Dba
	500 Hertz :	39 Dba
	1000 Hertz :	35 Dba
	4000 Hertz :	38 Dba
	8000 Hertz :	40 Dba

 - a. The exhaust silencer shall be sized to insure that the exhaust back pressure loss through the silencer shall not exceed 10.00 inches of water. The maximum exhaust flow velocity through the silencer outlet shall not exceed 10,500 feet per minute.
 - b. Provide 24-inch long stainless-steel flexible connections to the generator.
 - c. Dual-outlet engine shall be provided with a wye assembly connection with 24-inch-long, stainless-steel flexible connections to the generator and one common 18-inch outlet.
 - d. Catalytic converter shall reduce exhaust emissions by the following minimums:

- (1) Carbon monoxide (CO) 90 percent.
 - (2) Volatile organic compounds (VOCs) 75 percent
 - (3) Particulate matter larger than 10 microns: 70 percent
 - (4) Sulfur conversion: 20 percent of SO₂ converted to SO₃
- e. Catalytic converter shall have a port providing access to the catalyst array for service.
3. Exhaust piping shall be provided as specified in Division 15.
- Q. Piping requirements: See Division 15 for fuel piping requirements.
- R. Crankcase blowby system shall recirculate the engine blowby to the engine and have a collection device for the servicing of the system.
- S. Auxiliary oil: Automatic regulation auxiliary lube oil makeup tank, 50 gallons, with mechanical float switch and level glass.

2.3 GENERATORS, EXCITATION AND VOLTAGE REGULATION SYSTEMS

- A. Generators: The generator shall deliver voltage and power indicated at three-phase, 60-Hz, 0.80 power-factor, synchronous AC. Generator speed shall match the speed of the engine. Provide generator capable of supplying a 0.80 power-factor load equal to the gross kW rating of the generator, plus a 0.80 power-factor load 10 percent in excess of the gross kW rating of the generator at normal voltage, with a temperature rise of not more than 80 degrees C as measured by resistance and based on 40 degrees C ambient temperature. Provide general-purpose open type enclosures with ventilating openings covered with removable screens, and 120-V condensation heater for generator windings. Generator shall conform to ANSI C50.10, ANSI C50.13, and to NEMA MG 1. To ensure proper operation with high harmonic loads, the subtransient reactance for the generator shall be no more than 12.5 percent at the full load and the operating voltage.
- B. Excitation and voltage regulatory system: Excitation system shall comply with IEEE standard 421. Provide permanent magnet type, together with a static type voltage regulating system, and including surge protection and required accessories.
 1. Provide completely solid-state voltage regulators for control of generator voltage by control of the exciter field, suitable for mounting in generator. Regulator shall control generator exciter field as required to maintain a constant and stable generator output voltage within plus or minus 1/2 of one percent of nominal for all steady-state loads. Maintain generator output from no load to full load including a 5 percent variation in frequency and the effects of field heating.
- C. Engine-generator set control: Digital microprocessor-based control system designed to provide automatic starting, monitoring, and control functions for the generator set and to allow local and remote monitoring and control by the existing monitoring and control system.

1. Mounting on the generator set, vibration isolated.
2. The control shall be UL508 listed, CSA282-M1989 certified, and meet IEC8528 part 4. Switches, lamps and meters shall be oil-tight and dust-tight, and the enclosure door shall be gasketed. There shall be no exposed points in the control (with the door open) that operate in excess of 50 volts. The controls shall meet or exceed the requirements of Mil-Std 461C part 9, and IEC Std 801.2, 801.3, and 801.5 for susceptibility, conducted, and radiated electromagnetic emissions. The entire control shall be tested and meet the requirements of IEEE 587 for voltage surge resistance.
3. The generator set mounted control shall include the following control devices:
 - a. Mode select switch shall initiate the following control modes: When in the RUN or Manual position the generator set shall start, and accelerate to rated speed and voltage as directed by the operator. In the OFF position the generator set shall immediately stop, bypassing all time delays. In the AUTO position the generator set shall be ready to accept a signal from a remote device to start and accelerate to rated speed and voltage.
 - b. EMERGENCY STOP switch: "Red mushroom-head" pushbutton. Depressing the emergency stop switch shall cause the generator set to immediately shut down, and be locked out from automatic restarting.
 - c. RESET switch: Shall be used to clear a fault and allow restarting the generator set after it has shut down for any fault condition.
 - d. PANEL LAMP switch: Depressing the panel lamp switch shall cause the entire panel to be lighted with DC control power. The panel lamps shall automatically be switched off 10 minutes after the switch is depressed, or after the switch is depressed a second time.
4. Generator set ac output metering:
 - a. Analog voltmeter, ammeter, frequency meter, and kilowatt (kW) meter. Voltmeter and ammeter shall display all three phases. Ammeter and kW meter scales shall be color coded in the following fashion: readings from 0-90 percent of generator set standby rating: green; readings from 90-100 percent of standby rating: amber; readings in excess of 100 percent: red.
 - b. Digital metering set, 0.5 percent accuracy, to indicate generator rms voltage and current, frequency, output current, output kW, kW-hours, and power factor. Generator output voltage shall be available in line-to-line and line-to-neutral voltages, and shall display all three phase voltages (line to neutral or line to line) simultaneously.
5. Generator set alarm and status message display in the paralleling switchgear: High-intensity LED Indicating lamps shall indicate non-automatic generator status, and existing alarm and shutdown conditions. The lamp condition shall be clearly apparent under bright room lighting conditions. The following alarm and shutdown conditions shall be indicated on a digital display panel:
 - a. low oil pressure (alarm)
 - b. low oil pressure (shutdown)

- c. oil pressure sender failure (alarm)
- d. low coolant temperature (alarm)
- e. high coolant temperature (alarm)
- f. high coolant temperature (shutdown)
- g. engine temperature sender failure (alarm)
- h. low coolant level (alarm or shutdown--selectable)
- i. fail to crank (shutdown)
- j. overcrank (shutdown)
- k. overspeed (shutdown)
- l. low DC voltage (alarm)
- m. high DC voltage (alarm)
- n. weak battery (alarm)
- o. low fuel-daytank (alarm)
- p. high AC voltage (shutdown)
- q. low AC voltage (shutdown)
- r. under frequency (shutdown)
- s. emergency stop (shutdown)

- (1) In addition, provisions shall be made for indication of two customer-specified alarm or shutdown conditions. Labeling of the customer-specified alarm or shutdown conditions shall be of the same type and quality as the above-specified conditions. The nonautomatic indicating lamp shall be red, and shall flash to indicate that the generator set is not able to automatically respond to a command to start from a remote location.

6. Engine status monitoring: A digital status panel on the generator set control shall indicate:

- a. engine oil pressure (psi and kPa)
- b. engine coolant temperature (degrees F and C)
- c. engine coolant pressure (psi)
- d. engine oil temperature (degrees F and C)
- e. engine speed (rpm)
- f. number of hours of operation (hours)
- g. number of start attempts
- h. fuel oil pressure (psi and kPa)
- i. battery voltage (DC volts)
- j. Data logging and display shall allow logging of the last 10 warning or shutdown indications on the generator set, as well as total time of operation at various loads, as a percent of the standby rating of the generator set.

7. Generator control functions:

- a. Cycle cranking system shall allow for user-selected crank time, rest time, and number of cycles. Initial settings shall be for 3 cranking periods of 15 seconds each, with 15-second rest period between cranking periods.

- b. Idle mode control shall allow the engine to run in idle mode in the RUN position only. In this mode, the alternator excitation system shall be disabled.
 - c. Engine governor control shall provide steady-state frequency regulation, and shall include adjustments for gain, damping, and a ramping function to control engine speed and limit exhaust smoke while the unit is starting. The governor control shall be suitable for use in paralleling applications without component changes.
 - d. Time delay start (adjustable 0-300 seconds) and time delay stop (adjustable 0-600 seconds).
 - e. Sender failure monitoring logic for speed sensing, oil pressure, and engine temperature shall be capable of discriminating between failed sender or wiring components, and an actual failure condition.
8. Alternator control functions:
- a. Automatic digital voltage regulation system shall be matched and prototype tested with the governing system provided. It shall be immune from misoperation due to load-induced voltage waveform distortion and provide a pulse width modulated output to the alternator exciter. The voltage regulation system shall be equipped with three-phase rms sensing and shall control buildup of ac generator voltage to provide a linear rise and limit overshoot. The system shall include a torque-matching characteristic, which shall reduce output voltage in proportion to frequency below a threshold of 58-59 Hz. The voltage regulator shall include adjustments for gain, damping, and frequency roll-off. Adjustments shall be broad range, and made via digital raise-lower switches, with an alphanumeric LED readout to indicate setting level.
 - b. The voltage regulation system shall include provisions for reactive load sharing and electronic voltage matching for paralleling applications.
 - c. A battery monitoring system shall initiate alarms when the dc control and starting voltage is less than 25Vdc or more than 32 Vdc. During engine starting, the low voltage limit shall be disabled, and if dc voltage drops to less than 14.4 volts for more than two seconds a "weak battery" alarm shall be initiated.
9. Control Interfaces for Remote Monitoring: Provide all control and interconnection points from the generator set to the paralleling switchgear cubicle for generator number 4. No field connections shall be made in the control enclosure or in the ac power output enclosure. Provide the following features in the control system:
- a. Form C dry common alarm contact set rated 2A at 30Vdc to indicate existence of any alarm or shutdown condition on the generator set.
 - b. One set of contacts rated 2A at 30Vdc to indicate generator set is ready to load. The contacts shall operate when voltage and frequency are greater than 90 percent of rated condition.

- c. Fused 10 amp switched 24Vdc power supply circuit for customer use. Dc power shall be available from this circuit whenever the generator set is running.
- d. Fused 20 amp 24Vdc power supply circuit for customer use. Dc power shall be available from this circuit at all times from the engine starting/control batteries.
- e.. Provide modifications to existing paralleling switchgear programming to include the fourth generator.

2.4 SOURCE QUALITY CONTROL

- A. Perform factory tests and inspections on the diesel engine, prior to shipment. Test procedures shall conform to ASME, IEEE, and ANSI standards, and to ISO standard practices section on testing, as appropriate and applicable. Equipment necessary for tests shall be provided by the manufacturer performing the tests, and measuring and indicating devices shall be certified correct or correction data furnished for the device. Tests shall indicate satisfactory operation and attainment of guarantees and specified performance. If satisfactory, equipment tested will be given a tentative approval. Following installation of all permanent equipment, perform further tests to insure satisfactory operation.
- B. Generating unit shop tests: Perform customary commercial factory tests on each engine, including but not necessarily limited to, the following:
 - 1. Perform hydrostatic test on water jackets to assure that water seals and water jackets are water tight. Test report shall indicate pressure at which test was made and the results.
 - 2. Place generating units in continuous operation without stoppage for a period of not less than 10 hours. Operate for 2 hours at each load point (1/4, 1/2, 3/4, and full load) at 0.80 power factor. If stoppage becomes necessary during this period, repeat the run. Also record the following data at the start, at 15-minute intervals, and at the end of each load run:
 - a. Fuel consumption (correct fuel consumption results to guarantee conditions)
 - b. Exhaust temperatures and emissions.
 - c. Jacket water temperatures, lube oil temperatures and pressures, crankcase vacuum, and any other data of importance.
- C. Generator tests: Temperature tests on the generator to be provided in this contract shall be performed by the manufacturer of the equipment in his own factory prior to installation on the generating unit mounting base. Temperature tests shall be in accordance with IEEE 115. Generator tests shall include insulation resistance, dielectric resistance, open circuit saturation, short circuit saturation, zero power factor, 60 Hz saturation curve, direct-axis transient reactance, and negative sequence reactance tests. All test data shall be submitted for approval. Calculations of the subtransient reactance using test values shall be included in the test report.

PART 3 - EXECUTION

3.1 INSTALLATION OF DIESEL GENERATING UNIT

- A. Diesel generating unit and miscellaneous mechanical equipment: Install in accordance with manufacturer's instructions and with accepted practices for good workmanship. Unload, move, and put in place using methods recommended by the manufacturer and under the supervision of an experienced erecting engineer.
 - 1. Provide devices to support equipment not supported on concrete foundations in position as indicated. Fabricate supports of structural steel sections, plates or rods, and arrange to provide rigid and sturdy support. Provide connections and fasteners required between equipment supports and building structures.
 - 2. Install diesel generating unit on a concrete foundation as indicated. Provide vibration isolators to isolate vibrations from the diesel generating unit to the foundation. Type, number, and arrangement of the isolators shall be as recommended by the manufacturer of the assembled unit.
 - 3. Provide anchor bolts and sleeves for installation of the unit on concrete. Provide anchor bolts and sleeves of the type, size, and metallurgy recommended by the manufacturer of assembled unit. Place anchor bolts and sleeves for the diesel generating unit in strict accordance with details provided by the manufacturer of the assembled unit.
 - 4. Before assembly or installation, thoroughly clean all equipment. Remove all temporary protective coatings and foreign materials. After installation of equipment, clean all external surfaces. Remove oil, grease, dirt, and foreign material. Touch up shop paint and primer coats and leave surfaces ready for finish painting.
 - 5. Align in accordance with manufacturer's recommendations before equipment is placed in operation.
 - 6. After equipment is ready to be placed in service, fully instruct plant operators in operation and maintenance of the equipment.

3.2 INSTALLATION OF OTHER ELECTRICAL EQUIPMENT AND MATERIALS

- A. Electrical equipment and materials: Unless indicated or specified otherwise, install materials and equipment in accordance with the standards, codes, and regulations listed in the specifications. Install all equipment in strict conformance with manufacturer's instructions and recommendations.
- B. Batteries and chargers: Install in accordance with manufacturer's instructions. If batteries are to be stored during the construction period, follow manufacturer's instructions as to charging and protection from freezing.

3.3 FIELD TESTS AND INSPECTIONS

- A. General: Perform field tests and trial operations, and conduct all field inspections except final field inspection. Provide labor, equipment, and incidentals required for the tests. Rectify deficiencies found and retest work affected by such deficiencies at no addition to the contract sum.

- B. Testing agency: Engage a qualified independent testing agency to perform specified acceptance testing of the generators: See Section 16950.
- C. Electrical equipment and materials tests: Conduct tests, inspections and sampling in accordance with the specifications referenced herein, and as noted below:
1. Provide phase relationship tests as follows: Check connections to equipment for proper phase relationship. During such check, disconnect devices which could be damaged by the application of voltage or reversed phase sequence.
 2. Provide insulation resistance tests as follows: Perform on cables and equipment as listed herein. Make tests with motor-driven or rectifier type insulation resistance testers having ranges of 500 and 2,500 Vdc. Disconnect all solid-state and other equipment which may be damaged by such tests before tests are made. Tests shall measure insulation resistance from line to ground. Test cables after placement of cables and completion of terminations, but before connection to equipment. Test 600 volt class circuits and equipment, including current transformer and potential transformer secondary circuits and equipment, with the 500 volt tester range. Conform to manufacturers minimum acceptable values of insulation resistance of circuits and equipment. Submit test reports listing test equipment used, person or persons performing the tests, date tested, circuits or equipment tested, and results of all tests.
- D. Diesel generating unit acceptance tests: When installation is complete and in first-class operating condition, notify the Government in writing that the generating units and auxiliary equipment are ready for final field tests. Perform other tests as necessary or desirable to make certain that all equipment is functioning properly. Tests shall include the following:
1. A test to determine generating unit speed regulation under a gradual change from zero to full load.
 2. A test to determine generating unit instantaneous speed change with 25 percent load on or off.
 3. A test to ensure proper functioning of the overspeed trip.
 4. An individual test of each pressure and temperature alarm switch.
 5. Inspect all auxiliary equipment including, but not limited to, pumps, radiators, instruments, and special valves to assure proper operation. Any or all auxiliary equipment may be field tested. In general, test auxiliary equipment in accordance with the applicable ASME and IEEE performance test codes. If no code exists for the equipment to be tested, perform tests as directed. Perform generating unit tests in accordance with the provisions of the Field Test Code, as set forth in DEMA Standard Practices, except as modified herein. Furnish and install a temporary suitable water rheostat for loading the generating unit under test. Perform operational tests of a minimum duration of 10 hours at varying loads to demonstrate satisfactory performance of all automatic and parallel operations. Conduct tests during this period not less than 2 hours at each load (1/4, 1/2, 3/4, and full), with an interval of at least 30 minutes between tests after operation is stabilized at a given load. After the full load tests, conduct a test of 110 percent of full load for 2 hours to demonstrate smokeless combustion, adequacy of capacity of engines and complementary equipment, and freedom from undue strain. Check oil after tests for

presence of metal filings or water. Provide and install all temporary instrumentation, piping, and electrical wiring and make all electrical connections required for the generating unit tests. Provide temporary load banks equal to the total capacity of the unit.

- E. Test reruns: If the specified performance is not indicated by these tests, make such adjustments and changes, as necessary, and conduct additional tests, as necessary, to further check the performance of the equipment. Contractor shall bear all costs of such additional tests, including cost of fuel used.
- F. Test emergency power system: After completion and acceptance of the generator tests, perform an operational test of the emergency power system. Coordinate with the Government for a simulated power outage. This shall be performed by interrupting the normal power at each low voltage switchgear in succession and verifying proper generator start and transfer switch and paralleling gear operation.
- G. Failure to meet requirements: Any equipment proven to be faulty or inadequate for the service specified will be rejected, however the owner has the right to operate the rejected equipment until such time as new equipment is provided by the Contractor to replace the equipment rejected.
- H. Verify correct operation of monitoring system.
- I. Contractor's tests shall be scheduled and documented.

3.4 OPERATING INSTRUCTIONS

- A. Provide at least four hours of additional instruction time for the equipment specified in this section.

3.5 TRAINING

- A. Training of the Government's operation and maintenance (O&M) personnel is required. Provide competent, factory-authorized personnel to provide instruction to O&M personnel concerning the location, operation, and troubleshooting of the installed systems.

END OF SECTION 16231

SECTION 16341 - MEDIUM-VOLTAGE SWITCHGEAR

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Switchgear, interior, 15 kV.
- B. Vacuum breakers for existing switchgear, 15 kV.

1.2 RELATED SECTIONS

- A. Raceways and Boxes: Section 16130.
- B. Apparatus inspection and testing: Section 16950.
- C. Generators: Section 16231.

1.3 REFERENCES

- A. ANSI/IEEE C37.20.2: Metal-Clad Medium Voltage Switchgear.
- B. ANSI/IEEE C3T.20.3: Medium Voltage Load Interrupter Switchgear.

1.4 SUBMITTALS

- A. General: Comply with Section 01000.
- B. Product data:
 - 1. Switchgear
 - 2. Vacuum circuit breakers
 - 3. Accessories
- C. Shop Drawings:
 - 1. Switchgear: Furnish drawings that include, but are not limited to, the following:
 - a. Overall dimensions, weights, plan view, interior and exterior elevations and sections.
 - b. Ampere ratings of bus bars.
 - c. Maximum short-circuit bracing.
 - d. Circuit breaker type and ratings, continuous and load break rating.
 - e. Ratings and sizes of lugs, impedance, and taps.
 - f. Elementary diagrams and wiring diagrams with terminals identified and labeled to correspond to the designations on the equipment. Diagrams shall indicate prewired interconnections between items of equipment and the interconnection between the items.

- g. One-line diagram.
 - h. Manufacturer's published time-current curves of overcurrent relays to ensure that protection and coordination are achieved.
 - 2. Electric power monitoring: Submit wiring diagrams for components supplied under this section which are connected to the existing power monitoring system.
- D. Certifications:
 - 1. Qualifications of testing company.
 - 2. Copy of UL report verifying performance of specified finish.
- E. Test reports:
 - 1. Manufacturer's test report: For metal enclosed interrupter, certified report of tests of load interrupter in enclosures, with and without power fuses, showing that the integrated assembly safely withstands the fault as specified in Part 2 below.
 - 2. Field tests required in Part 3 below.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: In addition to the requirements specified in Division 1 Section "Quality Control," an independent testing agency shall meet OSHA criteria for accreditation of testing laboratories, Title 29, Part 1907, or shall be a full member company of the InterNational Electrical Testing Association.
 - 1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies, to supervise one site testing specified in Part 3.
- B. Subcontractor qualifications: The subcontractor performing work on the switchgear shall either have successfully performed such work on at least one similar installation, or shall engage the manufacturer's factory-trained technician who shall supervise and certify the work.
 - 1. Submit evidence of qualifications as required in "Submittals" above.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. While switchgear assemblies are stored or in place before being placed on service, energize the electric heaters specified in Part 2 below.

PART 2 - PRODUCTS

2.1 MEDIUM-VOLTAGE SWITCHGEAR (15 kV), METAL-ENCLOSED INTERRUPTER

- A. Furnish and install where indicated on the drawings an indoor, metal-enclosed switchgear arranged to receive the incoming medium-voltage feeder and serve as the primary device for Unit Substations.
- B. Do not fabricate until shop drawings have been approved.
- C. The switchgear shall consist of freestanding, miniature sized, self-supporting, indoor metal-enclosed switchgear comprised of fused load interrupter switch units as shown on drawings.
- D. The switchgear shall be rated as follows:
- | | | |
|----|-------------------------------------|--|
| 1. | Voltage: | |
| | Nominal | 13.8 KV |
| | Max Design | 14.5 KV |
| | BIL | 95 KV |
| 2. | Phase: | Three |
| 3. | Continuous Circuit | |
| | Main Bus | 600A |
| | Bus Taps | 600A |
| | Load Interrupter Switch | 600A |
| | Fuse holders | 400A (maximum) |
| 4. | Load interrupting current: | |
| | Load interrupter switch | 600A |
| 5. | Short circuit interrupting (fuses): | 750 MVA, 3 phase
symmetrical at 15 KV |
| 6. | Fault closing (load interrupter): | 40,000 amperes rms
Asymmetrical |
| 7. | Short Time: | |
| | Momentary: | 40,000 Amps rms
Asymmetrical |
- E. The switchgear shall be bolted to the concrete foundation pad using anchor bolt recommendations outlined by the switchgear manufacturer. Bays shall be arranged so that work in the cubicles and connections can be made from the front. Protected cables shall exit from the top and bottom of the switchgear units.
- F. The metal-enclosed switchgear assembly shall be integrally designed and produced by the manufacturer of the basic switching components, and constructed in accordance with the minimum construction specifications of the fuse manufacturer for space for fuse handling, and adequate space and venting, and strength for fuse exhaust.
- G. In compliance with NFPA 70 (NEC), the integrated assembly – load interrupter, power fuses and enclosure – shall safely withstand the effects of closing against a three-phase bolted fault of 40,000 amps asymmetrical while maintaining voltage of 13.8 kV. Test in the enclosure with doors and panels closed. Close the load interrupter against the fault with interruption of the fault by the power fuses (where furnished for short circuit protection), whereupon the fuse exhaust shall not blow open or warp the doors, panels, or enclosures,

nor blow out the inspection windows. Louvers shall be provided at the top, bottom, front, and rear of each unit.

- H. Load interrupters shall be group-operated, of the no-external-arc type. Interrupting action shall not release ionized gas into the enclosures nor produce arcing. Arcing contacts of the interrupting units shall be porcelain-enclosed and silver-tungsten-tipped. The main and hinge contacts of the switch blades shall be silver-to-silver surfaces.
- I. Each load interrupter shall contain a built-in quick-make, quick-break device so that high-speed closing and opening of the load interrupter is independent of the speed of the operating handle. The quick-make, quick-break device shall employ bearing of the anti-friction type only, and shall be assembled as an integral part of the load interrupter. Should the quick-make, quick-break device fail to develop or maintain its necessary stored energy (spring failure), positive opening or closing of the load interrupter shall be assured through an integral directly driven arrangement.
- J. Load interrupter operating handles shall be externally mounted and nonremovable, and shall provide latching accommodations for padlocking in either open or closed position.
- K. The fused load interrupter switch units shall contain three 13.8 kV, 400 A. (Max.), disconnecting type power fuses complete with snufflers and fuse refill units. The ampere rating of the fuse refill units shall be as indicated on the drawings. Provide three spare fuse holders with mufflers, six spare fuse refills of each size, one 1.5 inch by 4 feet epoxy fiberglass double-ended fuse handling stick complete with large fuse clamp on one end and station prong on the other.
- L. The enclosures shall be semi-monocoque and unitized construction, using 11-gauge cold-rolled sheet steel. Structural joints shall be welded. Butt joints shall also be welded with external seams ground flush and smooth. Internal welds shall be cleaned to remove scale. Side and rear sheets shall not be externally bolted. Each bay shall be a complete unit in itself, with full side sheets to minimize the number of bolts required to join adjacent bays during field installation. Four-inch structural steel channel bases shall be furnished.
- M. Doors shall be full length, 11 gauge cold rolled sheet steel bulkhead-type construction. Doors shall have 1.1875 inch minimum, 90-degree flanges formed from double-thickness folded edges approximately 1.3125 inch wide, with the sheared edges folded back into the inside of the door. The doors shall have concealed hinges with stainless steel pins, and foot-operated door holders. Door handles shall have provision for multiple padlocking. Each door shall be provided with a minimum of three latches, each latch to be of a design which places the latching member so as to withstand both outward and lateral forces. Two infrared inspection windows in each door shall allow open and closed positions of the load interrupter blades to be visible.
- N. Welds shall be ground and sanded. Internal welds, seams, joints and splices shall be wire brushed. After welding, all surfaces shall be phosphatized, etched, and finished with manufacturer's standard baked enamel. Color: light gray No. 61, ANSI Z55.1

- O. The medium-voltage main bus, taps, and ground bus in the switchgear shall be copper bar of not less than 0.25 by 2.5 inch cross section mounted on nontracking porcelain bus supports, constructed and braced as to withstand the short circuit stresses associated with the interrupting rating of the switchgear. Each bus bar connection shall be made of two bolts not less than 0.375-inch diameter and two Belleville spring washers with nuts. Minimum phase-to-ground clearance of energized busses shall be 7.5 inches. Hardware shall be hot-dipped galvanized steel. Provisions shall be made on the end bay for future extension of the main bus to future outgoing compartments.
- P. Insulating or supporting materials shall be noncombustible and suitable for nominal service voltage and ambient.
- Q. The ground bus shall extend through the full length of the switchgear. A section at least 12 inches long shall be located at the front of each compartment, with a clearance of not less than three inches to adjacent steel, to permit connection of six portable ground leads.
- R. Mechanical interlocks shall prevent opening the door of the interrupters unless the switch is open, or closing the switch if the door is open.
- S. Protective hinged and framed screen barriers, retained with captive thumb screws, in front of the load interrupter switches shall prevent inadvertent contact with the switch when the enclosure door is open. Each screen barrier shall be provided with sign "WARNING - ENERGIZED BUS".

2.3 VACUUM CIRCUIT BREAKERS FOR EXISTING MEDIUM-VOLTAGE METAL-CLAD SWITCHGEAR

- A. Each vacuum circuit breaker shall be an electrically operated, three-pole, circuit interrupting device rated as indicated at maximum voltage of 15 kV and 95 kV BIL. Breaker shall be designed for service on a 13.2 kV, 60 Hz system with a short-circuit capacity of not less than 750 MVA. Rating shall be based on ANSI/IEEE C37.04 and ANSI C37.06. Breaker frame size shall be as indicated. Circuit breaker shall be drawout-mounted with position indicator, operation counter, auxiliary switches, and primary and secondary disconnect devices. Circuit breaker shall be operated by an electrically charged, mechanically and electrically trip-free, stored-energy operating mechanism. Circuit breaker control voltage shall be 125 Vdc.
- B. Main drawout contacts: Silver-plated, multifinger, positive pressure, self-aligning type.
- C. Each drawout breaker shall be provided with three-position operation. The connected position and the test/disconnect position shall each be clearly identified by an indicator on the circuit breaker front panel.
 - 1. Connected position: Contacts are fully engaged. Breaker shall be tripped before it can be racked into or out of this position.
 - 2. Test/disconnect position: Position shall allow for complete testing and operation of the breaker without energizing the primary circuit.

3. Withdrawn (removed) position: Places breaker completely out of compartment, ready for removal.
- D. Vacuum breakers shall be suitable for installation in the existing Caterpillar “PowerLynx” paralleling switchgear. Breakers shall match existing GE power/vac breakers.

2.4 PROTECTIVE RELAYS FOR VACUUM CIRCUIT BREAKERS

- A. Overcurrent protective relays for the 15 kV switchgear shall be utility grade, solid-state, microprocessor-based, multifunctional type operating from the 5-A output of current transformers, completely assembled and wired in a single device.
1. Phase time overcurrent (Device 50/51), instantaneous overcurrent (Device 50/51G), or ground fault protection (Device 50/51N), shall be incorporated in the protective relay device.
 - a. Provide 50/51N protective functions for each of the three phases.
 - b. Provide 50/51N or 50/51G protective functions as shown on drawings or as determined by the coordination study.
 2. Provide true rms sensing of each phase and ground.
 3. Ground element: Capable of being used in residual, zero sequence, or ground source connection schemes, or deactivated.
- B. Relays shall be field-programmable for phase and ground protection current transformer ratios up to 5000:5.
- C. Phase and ground protection curves shall be independently field-selectable and programmable with or without load.
1. Curves shall be selectable from:
 - a. IEEE moderately inverse, very inverse, extremely inverse.
 - b. IEC A, B, C, or D.
 - c. Thermal Flat, I_t , I^2t , I^4t .
 2. Thermal curves shall be similar to those on low-voltage trip units and closely coordinated with downstream devices.
 3. Short delay pickup and short delay time settings shall be selectable.
 4. The phase instantaneous overcurrent trip shall have field-programmable pickup points from 1 to 25 times current transformer primary rating or NONE.
 5. When phase instantaneous overcurrent has been programmed to NONE, a field-selectable ON or OFF discriminator circuit shall protect against currents exceeding 11 times current transformer primary rating, only when the breaker is closed.
- D. The relay shall be field-configurable to have either of 2 function combinations assigned to its 2 type a contacts:

1. One contact assigned 51 phase and 51 ground and the other assigned 50 phase and 50 ground.
 2. One contact assigned 51/50 phase and the other contact assigned 51/50 ground.
- E. Display: Built-in alphanumeric display shall show the following information with metering accuracy of +/- one percent of full scale (1_n) from $0.04 \times 1_n$ to $1 \times 1_n$) and +/- 2 percent of full scale (1_n) from $1 \times 1_n$ to $2 \times 1_n$:
1. Individual phase currents.
 2. Ground current.
 3. Cause of trip.
 4. Magnitude current causing trip.
 5. Phase or ground indication.
 6. Peak current demand for each phase and ground since last reset.
 7. Current transformer primary rating.
 8. Programmed phase and ground setpoints.
- F. Integral manual testing for both phase and ground protection function shall be selectable to operate contact outputs or not.
- G. Zone selective interlocking capability for phase and ground fault protection, either factory-wired as an integral part of the relay, or relay provided with full bus differential scheme for both phase and ground in addition to specified time overcurrent and instantaneous overcurrent phase and ground fault protection.
- H. Internal circuitry shall be continuously self-testing.
- I. Failure alarm contact.
- J. Lockout and self reset after trip function: Programmable.
- K. Setpoints for device curve selection: Programmable.
- L. Inputs such as current transformer ratios: Programmable.
- M. Hinged cover shall protect access to program and test modes.
- N. Operating conditions: Temperatures from -30 to 55 degrees C and relative humidity (noncondensing) from 0 to 95 percent.
- O. Relay shall be suitable for communication via a LAN with the existing monitoring system.
1. Relay shall be able to transmit information contained in the relay including currents, setpoints, cause of trip, magnitude of trip current, and open or closed trip status.
 2. When dipswitch is configured in remote close/open mode, the relay shall be able to close and open the associated breaker with proper access code from remote location over the communication network.

- P. Alarm and trip contacts:
 - 1. Shall not change state if power is lost or an undervoltage occurs.
 - 2. Shall only cause a trip upon detection of an overcurrent or fault condition based on programmed settings.
 - 3. Protection off alarm shall be normally energized when the relay is powered and the self-diagnostics indicate unit is functioning properly. Upon loss of power or relay failure, the alarm relay shall be deenergized, triggering the alarm.
- Q. Power requirements: Relay shall operate on control power with input voltage of 125 Vdc.
- R. Auxiliary and lockout relays: Provide where shown on drawings and where required for proper functioning of the protective relaying and circuit-breaker control systems.

2.5 INSTRUMENT TRANSFORMERS

- A. ANSI/IEEE C57.13, as applicable.
- B. Current transformers: Dry type, multi-ratio with taps for 50, 75, and 100 percent of indicated ratio, 60 Hz, and coordinated to the rating of the associated switchgear, relays, meters, and instruments, with an accuracy class of C-50 or better. They shall be capable of withstanding the maximum momentary current rating of the breakers. Phase CTs shall be mounted over stationary primary disconnects. Ground fault sensor CTs shall be mounted in cable compartments and sized to accommodate power cables. Current transformers for the incoming feeder shall have a ratio of 400:5 or greater.
- C. Potential transformers: Dry type, 60 Hz, with voltage ratings and ratios coordinated to the ratings of the associated switchgear, relays, meters, and instruments, and with two fuses in the primary. Fuses shall be current limiting and sized as recommended by the potential transformer manufacturer. Potential transformers shall have a full wave impulse level of 95 kV and shall be drawout type. Fuses shall be readily accessible. The drawout units shall be designed to automatically ground the potential transformer primary and disconnect the secondary when the unit is withdrawn from its compartment. The secondary disconnect devices shall be of a positive contact design and shall be visible and accessible when the unit is withdrawn. The maximum ratio and phase angle errors, when carrying full secondary burdens, shall not exceed standard classifications. The supplier shall determine that the actual volt-ampere burdens are within the thermal ratings and accuracy range of the transformer.

2.6 PILOT DEVICES, HEATERS AND ACCESSORIES FOR VACUUM CIRCUIT BREAKERS

- A. Pilot and indicating lights: Transformer, resistor, or diode type, mounted on the hinged front doors of breaker and auxiliary compartments.
- B. Control and instrument switches: Switchboard type and of rotary type construction, mounted on the hinged front doors of the breaker and auxiliary compartments unless otherwise indicated.

- C. Provide factory-installed relays for the supervisory system as required and as indicated on the drawings. Addressable relays shall be compatible with the existing monitoring system.

2.7 SWITCHGEAR CONTROL WIRING

- A. Control circuit wiring: Type SIS, or approved equal, stranded, insulated switchboard wire, No. 14 AWG or larger depending upon the ampacity of the circuit.
- B. Wires shall be terminated with insulated ring tongue type terminals if No. 10 AWG and smaller. Wires shall be terminated with uninsulated lugs with inspection holes if wire gage is greater than No. 10 AWG.
- C. Current transformer neutrals shall be wired to terminal blocks.
- D. All control wires shall be identified at each end with permanent tags marked to agree with drawing designations.
- E. Terminal blocks and points shall not have more than two wires connected to any point. Terminal blocks shall be provided with white marking strips and where used for current transformer connections shall be of the shorting type. Only CT conductors shall be connected to CT terminal blocks.

2.8 INSULATED BARRIERS

- A. Where insulated barriers are required by reference standards, provide barriers in accordance with NEMA LI 1, Type GPO-3, 6.4 mm minimum thickness.

2.9 FINISH

- A. Corrosion-resistant coating for switchgear enclosure: Certified in accordance with UL 1332 to withstand no less than 600 hours when exposed to the 5 percent salt spray test.
 - 1. Pretreatment: Phosphatized and sealed.
 - 2. Powder coating: Baked, no less than 1.4 mil thick.
 - 3. Finish enamel no less than 1.5 mil thick.
- B. Exterior surface of switchgear shall be light gray No. 61 in accordance with ASTM D 1535.

2.10 CORROSION PROTECTION

- A. Bases, frames, and channels of substations and switchgear which come in contact with concrete shall have manufacturer's standard corrosion-resistant treatment.

2.11 TERMINAL BOARDS

- A. Provide with engraved plastic terminal strips and screw type terminals for external wiring between components and for internal wiring between removable assemblies. Terminal boards associated with current transformers shall be short-circuiting type. Terminate

conductors for current transformers with ring-tongue lugs. Terminal board identification shall be identical in similar units. External wiring shall be color coded consistently for similar terminal boards.

2.12 WIRE MARKING

- A. Mark control and metering conductors at each end. Provide factory-installed white plastic tubing heat stamped with black block type letters on factory-installed wiring. On field-installed wiring, provide multiple white preprinted polyvinyl chloride (PVC) sleeves, heat stamped with black block type letters. Each sleeve shall contain a single letter or number, shall be elliptically shaped to fit the wire securely, and shall be keyed, or otherwise arranged, in such a manner to ensure alignment with adjacent sleeves. Provide specific wire markings using the appropriate combination of individual sleeves. Wire markers for factory-installed conductors shall indicate wire designations corresponding to the schematic drawings. Wire markers on field-installed conductors shall indicate the device or equipment, including specific terminal number to which the remote end of the wire is attached, as well as the terminal number to which the wire is directly attached (near end/far end marking).

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with ANSI C2, NFPA 70, and specified requirements.

3.2 GROUNDING

- A. NFPA 70 and ANSI C2 except that grounds and grounding systems shall have a resistance to solid earth ground not exceeding 5 ohms. All non-current-carrying metal parts of the substation shall be connected to the ground system. The switchgear ground bus shall be connected at a minimum of two places to the ground system with minimum 4/0 bare copper wire.
- B. Connections: Double-bolted compression connectors shall be used for above-grade ground connections to equipment ground bus.
- C. Grounding and bonding equipment: UL 467.

3.3 INSTALLATION OF EQUIPMENT AND ASSEMBLIES

- A. Install and connect switchgear and miscellaneous devices furnished under this section as indicated on project drawings, the approved shop drawings, and as specified herein.
- B. Medium-voltage switchgear: ANSI/IEEE C37.20.2 or ANSI/IEEE C37.20.3 as applicable.
- C. Galvanizing repair: ASTM A 780, using galvanizing repair paint for galvanizing damaged by handling, transporting, cutting, welding, or bolting. Do not heat surfaces that repair paint has been applied to.

- D. Install on housekeeping pad.
- E. Install vacuum breakers and accessories in existing switchgear.

3.4 FIELD QUALITY CONTROL

- A. Performance of acceptance checks and tests: Engage an independent testing agency to perform acceptance tests. In accordance with the manufacturer's recommendations, NFPA 70B, NETA ATS as applicable to switchgear, and referenced ANSI standards. Perform tests specific to medium-voltage circuit breakers, relays, metering, and instrument transformers in accordance with Section 16950. Perform tests to obtain information about the performance of breakers, meters, wiring, and instrument transformers together, as well as separately. The Government will witness formal tests after receipt of written certification that preliminary tests have been completed and that system is ready for final test and inspection. Before the new substations may be energized, copies of inspection reports and acceptance tests shall be forwarded to the power company for approval.
- B. Follow-up verification: Upon completion of acceptance checks, settings, and tests, demonstrate in service that circuits and devices are in good operating condition and properly performing the intended function. Circuit breakers shall be tripped by operation of each protective device. Test shall require each item to perform its function not less than three times. In addition to requirements stated elsewhere in the contract, notify the Government 5 working days in advance of the dates and times for checks, settings, and tests.
- C. Certificate of electrical inspection: Obtain a certificate of electrical inspection covering all new switchgear from the authority having jurisdiction, before energizing the equipment.
- D. Verify correct operation of monitoring system.

3.5 TRAINING

- A. Training of the Government's operation and maintenance (O&M) personnel is required. Provide competent, factory-authorized personnel to provide instruction to O&M personnel concerning the location, operation, and troubleshooting of the installed systems.

END OF SECTION 16341

SECTION 16361 - SECONDARY UNIT SUBSTATIONS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Secondary unit substations, each consisting of the following:
 - 1. Incoming section.
 - 2. Transformer section.
 - 3. Secondary distribution section.
- B. Related Sections include the following:
 - 1. Section 16124 – Medium-Voltage Cables for cable terminations at switchgear.
 - 2. Section 16341 – Medium-Voltage Switchgear.
 - 3. Section 16441 – Switchboards.
 - 4. Section 16950 – Apparatus Inspection, and Testing.

1.2 SUBMITTALS

- A. General: Comply with Section 01000.
- B. Product Data: For substation components.
- C. Shop Drawings: Show details of equipment assemblies and indicate dimensions, weights, loadings, required clearances, method of field assembly, components, and location and size of each field connection for each substation. Include the following:
 - 1. Dimensioned plans and elevations showing major components and features.
 - 2. One-line diagram.
 - 3. Materials list.
 - 4. Nameplate legends.
 - 5. Size and number of bus bars and current rating for each bus, including mains and branches of phase, neutral, and ground buses.
 - 6. Short-time and short-circuit current ratings of substations and components.
 - 7. Ratings of individual protective devices.
- D. Time-Current Characteristic Curves: For overcurrent protection devices.
- E. Product Certificates: Signed by manufacturers of substation components certifying that the products furnished comply with requirements.
- F. Qualification Data: For firms and persons specified in “Quality Assurance” Article.
- G. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

- H. Product Test Reports: Indicate compliance of substations with requirements.
- I. Maintenance Data: For substations to include in the maintenance manuals specified in Division 1.

1.3 QUALITY ASSURANCE

- A. Testing Agency Qualifications: In addition to the requirements specified in Division 1 - Testing Laboratory Services, an independent testing agency shall meet OSHA criteria for accreditation of testing laboratories, Title 29, Part 1907, or shall be a full member company of the InterNational Electrical Testing Association.
 - 1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies, to supervise on-site testing specified in Part 3.
- B. Listing and Labeling: Provide electrically operated equipment specified in this Section that is listed and labeled.
 - 1. The Terms "Listed" and "Labeled": As defined in the National Electrical Code, Article 100.
 - 2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" as defined in OSHA Regulation 1910.7.
- C. Comply with NFPA 70.
- D. Comply with ANSI C2.
- E. Comply with IEEE C57.12.01.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver in shipping splits of size that can be moved past obstructions in delivery path as indicated.
- B. Coordinate delivery of secondary unit substations to allow movement into designated space.
- C. Store substation components protected from weather and so condensation will not form on or in units. Provide temporary heating according to manufacturer's written instructions.
- D. Handle substation components according to manufacturer's written instructions. Use factory-installed lifting provisions.
- E. Dimensions of substation components are critical. The dry-type transformer housing must be removed during transportation in the Capitol basement, and reinstalled in the electric rooms.

1.5 PROJECT CONDITIONS

- A. Field Measurements: Verify dimensions by field measurements.
- B. Determine suitable path for moving unit substation into place; consider Project conditions.
- C. Verify clearance requirements. Locate unit substation to meet installation tolerances.
- D. Revise locations and elevations from those indicated to those required to suit Project.

1.6 COORDINATION

- A. Coordinate size and location of concrete housekeeping bases. Cast anchor-bolt inserts into base.

PART 2 - PRODUCTS

2.1 SECONDARY UNIT SUBSTATIONS

- A. System Type: Radial.
- B. Arrangement: Indoor unit substation in single assembly. Provide connection between primary switch and transformer without a transition section.
- C. Primary Switch: Enclosed medium voltage fusible interrupter as specified in Section 16341 – Medium Voltage Switchgear.
- D. Transformer: Dry type.

2.2 FABRICATION AND FEATURES

- A. Enclosure Finish: Factory-applied finish in manufacturer's standard gray finish over a rust-inhibiting primer on treated metal surface.

2.3 ENCLOSED FUSIBLE INTERRUPTER

- A. See Section 16341 – Medium-Voltage Switchgear for metal-enclosed interrupter switch.

2.4 DRY-TYPE TRANSFORMER

- A. Description: NEMA ST 20 and IEEE C.57.12.01, dry-type, cast coil, 2-winding, power transformer.
- B. Enclosure: Indoor, ventilated.
- C. Cooling System: Class AA/FFA, air cooled with provisions for future forced-air rating.
- D. Insulation Class: 220 deg C.
- E. Insulation Temperature Rise: 80 deg C, maximum rise above 40 deg C.

- F. Basic-Impulse Insulation Level: 95 kV.
- G. Full-Capacity Voltage Taps: 4 nominal 2.5-percent taps, 2 more than and 2 less than rated high voltage.
- H. High-Temperature Alarm: Sensor at transformer with local audible and visual alarm and contacts for remote alarm.
- I. Terminations: Sidewall-mounted for close coupling to high- and low-voltage switchgear sections.
- J. Impedance: Plus or minus 5.75 percent. Sound level shall not exceed the maximum permitted by NEMA TR1 for the applicable kVA size of dry-type transformer.
- K. Forced-air cooling shall increase the allowable full-load kVA by 33.33 percent.
- L. Windings: Copper conductors for both high and low voltage.
 - 1. Phase windings: The primary and secondary coil assemblies shall be cast coil design and manufacture. Each cast coil shall be cast under vacuum to provide completely void-free epoxy resin impregnation throughout the entire insulation system.
 - 2. Coil supports shall maintain constant pressure during thermal expansion and contraction.
 - 3. There shall be no connection between high- and low-voltage coils.
- M. Enclosure: Sheet steel, no less than 12 gauge, with ventilating openings meeting requirements of NEMA and NEC standards for ventilated enclosures.
 - 1. Outgoing air: Side panel louvers.
 - 2. Incoming air: Through base.
- N. Base: Constructed to permit rolling or skidding in any direction and equipped with jacking pads flush with the enclosure.
- O. Future forced-air cooling: Provisions for mounting fans and fan control system, and bussing sized to the fan-cooled rating.

2.5 LOW-VOLTAGE SECONDARY SWITCHBOARD

- A. See Section 16441 – Switchboards, for the secondary switchboard of the unit substation.

2.6 IDENTIFICATION DEVICES

- A. Nameplates and label products are specified in Section 16075 - Electrical Identification.

1. Compartment Nameplates: Engraved, laminated-plastic or metal nameplate for each compartment, mounted with corrosion-resistant screws.

2.7 SOURCE QUALITY CONTROL

- A. Factory Tests: Perform design and routine tests according to standards specified for components.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine elements and surfaces to receive unit substation for compliance with requirements for installation tolerances and other conditions affecting performance of the unit substation. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Assemble and install unit substations according to manufacturer's written instructions.
- B. Install unit substations on concrete housekeeping base.

3.3 IDENTIFICATION

- A. Identify field-installed wiring and components and provide warning signs as specified in Section 16075 - Electrical Identification.
- B. Operating Instructions: Frame printed operating instructions for unit substations, including key interlocking, control sequences, and emergency procedures. Fabricate frame of finished wood or metal and cover instructions with clear acrylic plastic. Mount on front of unit substation.

3.4 CONNECTIONS

- A. Ground equipment to main electrical ground bus as indicated. Provide minimum 5-ohm ground resistance at substation location.
 1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified independent testing agency to perform specified acceptance testing. See Section 16950.
- B. Testing: After installing substation and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements.

- C. Remove and replace malfunctioning components with new units, and retest.
- D. Manufacturer's Field Service: Provide services of a factory-authorized service representative to supervise the field assembly of components and installation of substation, including piping and electrical connections, and to report results in writing.
 - 1. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.6 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Government's maintenance personnel as specified below:
 - 1. Train Government's maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing, and preventive maintenance.
 - 2. Review data in the maintenance manuals. Refer to Section 01000.
 - 3. Schedule training with at least 7 days' advance notice.
- B. Training of the Government's operation and maintenance (O&M) personnel is required. Provide competent, factory-authorized personnel to provide instruction to O&M personnel concerning the location, operation, and troubleshooting of the installed systems.

END OF SECTION 16361

SECTION 16441 - SWITCHBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes service and distribution switchboards rated 600 V and less.

1.3 DEFINITIONS

- A. EMI: Electromagnetic interference.
- B. GFCI: Ground-fault circuit interrupter.
- C. RFI: Radio-frequency interference.
- D. RMS: Root mean square.
- E. SPDT: Single pole, double throw.

1.4 SUBMITTALS

- A. General: Comply with Section 01000.
- B. Product Data: For each type of switchboard, overcurrent protective device, ground-fault protector, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
- C. Shop Drawings: For each switchboard and related equipment.
 - 1. Dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings. Include the following:
 - a. Enclosure types and details for types other than NEMA 250, Type 1.
 - b. Bus configuration, current, and voltage ratings.
 - c. Short-circuit current rating of switchboards and overcurrent protective devices.
 - d. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
 - 2. Wiring Diagrams: Power, signal, and control wiring.

3. Coordination Drawing: Provide scaled room plan, scale no smaller than 1/4 inch equals one foot, with dimensioned equipment locations and space requirements.
- D. Qualification Data: For testing agency.
- E. Field quality-control test reports including the following:
 1. Test procedures used.
 2. Test results that comply with requirements.
 3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.
- F. Operation and Maintenance Data: For switchboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 Section "General Requirements," include the following:
 1. Routine maintenance requirements for switchboards and all installed components.
 2. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
 3. Time-current curves, including selectable ranges for each type of overcurrent protective device.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
 1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.
- B. Source Limitations: Obtain switchboards through one source from a single manufacturer.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. Comply with NEMA PB 2, "Deadfront Distribution Switchboards."
- E. Comply with NFPA 70.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver in sections or lengths that can be moved past obstructions in delivery path.

- B. Store indoors in clean dry space with uniform temperature to prevent condensation. Protect from exposure to dirt, fumes, water, corrosive substances, and physical damage.
- C. If stored in areas subjected to weather, cover switchboards to provide protection from weather, dirt, dust, corrosive substances, and physical damage. Remove loose packing and flammable materials from inside switchboards; install electric heating (250 W per section) to prevent condensation.
- D. Handle switchboards according to NEMA PB 2.1 and NECA 400.

1.7 PROJECT CONDITIONS

- A. Installation Pathway: Remove and replace access fencing, doors, lift-out panels, and structures to provide pathway for moving switchboards into place.
- B. Interruption of Existing Electric Service: Do not interrupt emergency electric service to the Capitol except under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:
 - 1. Notify Government no fewer than seven days in advance of proposed interruption of emergency electric service.
 - 2. Indicate method of providing temporary emergency electric service.
 - 3. Demonstrate that temporary emergency electrical service is in place and operational.
 - 4. Do not proceed with interruption of emergency electric service without Government's written permission.

1.8 COORDINATION

- A. Coordinate layout and installation of switchboards and components with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

- A. Front-Connected, Front-Accessible Switchboard: Panel-mounted main device, panel-mounted branches.
- B. Nominal System Voltage: 480Y/277 V.
- C. Main-Bus Continuous: 2500 A and 1200 A.
- D. Circuit breaker distribution section: Group-mounted circuit breakers.

- E. Enclosure: Steel, NEMA 250, Type 1.
- F. Enclosure Finish for Indoor Units: Factory-applied finish in manufacturer's standard gray finish over a rust-inhibiting primer on treated metal surface.
- G. Hinged Front Panels: Allow access to circuit breaker, metering, accessory, and blank compartments.
- H. Buses and Connections: Three phase, four wire, unless otherwise indicated.
 - 1. Phase- and Neutral-Bus Material: Hard-drawn copper of 98 percent conductivity with feeder circuit-breaker line connections.
 - 2. Ground Bus: 1/4-by-2-inch- (6-by-50-mm-) minimum-size, hard-drawn copper of 98 percent conductivity, equipped with pressure connectors for feeder and branch-circuit ground conductors. For busway feeders, extend insulated equipment grounding cable to busway ground connection and support cable at intervals in vertical run.
 - 3. Contact Surfaces of Buses: Silver plated.
 - 4. Main Phase Buses, Neutral Buses, and Equipment Ground Buses: Uniform capacity for entire length of switchboard's main and distribution sections.
 - 5. Isolation Barrier Access Provisions: Permit checking of bus-bolt tightness.
 - 6. Neutral Buses: 50 percent of the ampacity of phase buses, unless otherwise indicated, equipped with pressure connectors for outgoing circuit neutral cables. Bus extensions for busway feeder neutral bus are braced.
- I. Bus Duct Connections: Provide 2,500-ampere copper bus duct flanged extensions from the top of sections for future connections. Bus duct rating shall be 100 percent for phases and 50 percent for neutral.

2.2 OVERCURRENT PROTECTIVE DEVICES

- A. Molded-Case Circuit Breaker: NEMA AB 3, with interrupting capacity to meet available fault currents.
 - 1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
 - 2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
 - 3. Electronic trip-unit circuit breakers shall have RMS sensing, field-replaceable rating plug, and the following field-adjustable settings:
 - a. Instantaneous trip.
 - b. Long- and short-time pickup levels.
 - c. Long- and short-time time adjustments.
 - d. Ground-fault pickup level, time delay, and I^2t response.

4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
- B. Molded-Case Circuit-Breaker Features and Accessories: Standard frame sizes, trip ratings, and number of poles.
 1. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor material.
 2. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.

PART 3 - EXECUTION

3.1 PROTECTION

- A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions.

3.2 EXAMINATION

- A. Examine elements and surfaces to receive switchboards for compliance with installation tolerances and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION

- A. Install switchboards and accessories according to NEMA PB 2.1 and NECA 40.
- B. Install and anchor switchboards level on concrete bases, 4-inch (100-mm) nominal thickness.
 1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around full perimeter of base.
 2. For switchboards, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 4. Install anchor bolts to elevations required for proper attachment to switchboards.
- C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from switchboard units and components.
- D. Install overcurrent protective devices, and instrumentation.
 1. Set field-adjustable switches and circuit-breaker trip ranges.

3.4 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 16 Section "Electrical Identification."
- B. Switchboard Nameplates: Label each switchboard compartment with engraved metal or laminated-plastic nameplate mounted with corrosion-resistant screws.

3.5 FIELD QUALITY CONTROL

- A. Prepare for acceptance tests as follows:
 - 1. Test insulation resistance for each switchboard bus, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.
- B. Testing Agency: Engage a qualified testing and inspecting agency to perform the following field tests and inspections and prepare test reports:
 - 1. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Sections 7.1, 7.5, 7.6, 7.9, 7.10, 7.11, and 7.14 as appropriate. Certify compliance with test parameters.
 - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

3.6 CLEANING

- A. On completion of installation, inspect interior and exterior of switchboards. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

3.7 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain switchboards, overcurrent protective devices, instrumentation, and accessories. Refer to Division 1 Section "General Requirements."

END OF SECTION 16441

SECTION 16950 - APPARATUS COORDINATION, INSPECTION, AND TESTING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Inspection and testing of 15 kV switchgear, unit substation transformers, switchboards, and generators.

1.2 REFERENCES

- A. NETA ATS: Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems

1.3 ELECTRICAL SYSTEM STUDY

- A. The study shall include all portions of the electrical distribution system from the generator plant power source down to and including the distribution switchboards and automatic transfer switches and panelboards. Normal system connections and those which result in maximum fault conditions shall be adequately covered.
- B. Do not begin the study until the qualifications of the testing organization and the individuals assigned to the project have been approved.
- C. Short circuit and protective device evaluation and coordination study.
 - 1. The short circuit study shall be performed with the aid of a digital computer program and shall be in accordance with the applicable IEEE and ANSI standards.
 - 2. In the short circuit study, provide calculation methods and assumptions, the base per unit quantities selected, one-line diagrams, source impedance data including power company system characteristics, typical calculations, tabulations of calculation quantities and results, conclusions, and recommendations. Calculate short circuit interrupting and momentary (when applicable) duties for an assumed 3-phase bolted fault at the 15 kV switchgear lineup, network transformer primary and secondary terminals, existing low-voltage switchgear and switchboards, automatic transfer switches, panelboards, and other significant locations throughout the system. Provide a ground fault current study for the same system areas, including the associated zero sequence impedance data. Include in tabulations fault impedance, X to R ratios, asymmetry factors, motor contribution, short circuit kVA, and symmetrical and asymmetrical fault currents.
 - 3. In the protective device coordination study, provide time-current curves graphically indicating the coordination proposed for the system, centered on conventional, full-size, log-log-forms. Include with each curve sheet a complete title and one-line diagram with legend identifying the specific portion of the system covered by that particular curve sheet. Include a detailed description of each protective device identifying its type, function, manufacturer, and time-current characteristics. Tabulate recommended device tap, time dial, pickup, instantaneous, and time delay settings.

4. Include on the curve sheets, system medium-voltage equipment relay and fuse characteristics, low-voltage equipment circuit breaker trip device characteristics, pertinent transformer characteristics, pertinent motor characteristics, and characteristics of other system load protective devices. Include at least all devices down to the low voltage distribution equipment.
 5. Include all adjustable settings for ground fault protective devices. Include manufacturing tolerance and damage bands in plotted fuse characteristics. Show transformer full load and 150, 400, or 600 percent currents, transformer magnetizing inrush, ANSI transformer withstand parameters, and significant symmetrical and asymmetrical fault currents. Terminate device characteristic curves at a point reflecting the maximum symmetrical or asymmetrical fault current to which the device is exposed.
 6. Separate transformer primary protective device characteristic curves from associated secondary device characteristics by a 16 percent current margin to provide proper coordination and protection in the event of secondary line-to-line faults. Separate medium-voltage relay characteristic curves from curves for other devices by at least a 0.4-second time margin.
 7. Include complete fault calculations for each proposed and ultimate source combination. Note that source combinations may include present supply circuits, and motors, as noted on Drawing diagrams.
 8. Utilize equipment load data for the study obtained from equipment nameplates and Contract Documents, including Addenda.
 9. Include fault contribution of all large motors in the study. Notify the owner in writing of circuit protective devices not properly rated for fault conditions.
- D. Study report: The results of the power system study shall be summarized in a final report. The report shall include the following:
1. Descriptions, purpose, basis and scope of the study.
 2. Tabulations of circuit breaker, fuse and other protective device ratings versus calculated short circuit duties, and recommendations regarding same.
 3. Protective device time versus current coordination curves, tabulations of relay and circuit breaker trip settings, fuse selection, and recommendations regarding same.
 4. Fault current calculations including a definition of terms and guide for interpretation of computer printout.

1.4 SUBMITTALS

- A. Submit in accordance with requirements of Section 01000
- B. Qualifications of independent testing organization(s) as required in "Quality Assurance" below.
- C. Qualifications of individuals performing the work as required in "Quality Assurance" below.
- D. Test procedures: Submit a test procedure for each item of equipment to be tested.

- E. Reports:
1. Electrical system study report.
 2. Inspection and testing report: Include certification of compliance with specified requirements, identify deficiencies, and recommend corrective action when appropriate.
 3. Written report documenting the results of each site visit, submitted not more than ten days after each visit.
 4. Test reports documenting the results of each test, submitted not more than ten days after test is completed.
- F. Operation and maintenance manuals: The representatives in charge of the work of this project shall assist in the preparation of operation and maintenance manuals. Submit with preliminary and final manuals certification from each representative that he or she has reviewed the manuals and finds them in compliance with the project requirements.

1.5 QUALITY ASSURANCE

- A. Electrical system study, and inspection, testing, calibration, and adjustment shall be performed by independent qualified organizations under the supervision of a representative in charge of the work. The representative shall stamp and sign the study report.
- B. Qualifications of testing organization:
1. Professionally independent of the manufacturers, suppliers, and installers of equipment or systems to be evaluated.
 2. Currently and regularly engaged in testing of electrical equipment, devices, installations, and systems.
 3. Meets the criteria for, or is, a Full Member company of the International Electrical Testing Association (NETA).
- C. Qualifications of study organization:
1. Currently involved in medium and low-voltage power systems evaluations.
 2. Has a record of experience and satisfactory performance on at least three similar projects.
- D. Qualifications of representative in charge of the study:
1. Registered professional engineer.
 2. Has at least 5 years experience in power system analysis.
- E. Qualifications of representative in charge of inspection and testing:
1. Currently certified by NETA or by the National Institute for Certification in Engineering Technologies, in electrical power distribution system testing.

- F. Qualifications of individuals assigned to the work of this project: Technicians regularly employed by the firm for testing services.
- G. Test instrument calibration:
 - 1. Testing organization shall have a calibration program which assures that the test instruments are maintained within rated accuracy.
 - 2. Accuracy shall be directly traceable to the National Institute of Standards and Technology (NIST).

PART 2 - PRODUCTS

Not Applicable.

PART 3 - EXECUTION

3.1 FIELD SETTINGS AND PREPARATION FOR TESTING

- A. In accordance with the approved electrical system study, perform field adjustments of the protective devices as required to place the equipment in final operating condition. Field settings and minor modifications to equipment to accomplish compliance with the approved study are part of the work of the contract, and shall be accomplished with no addition to the contract sum.
- B. Before testing is to begin, furnish to the testing organization complete sets of shop drawings, settings of adjustable devices, and other information necessary for accurate inspection and evaluation of the system.
- C. Test procedures, submitted as required in "Submittals" in Part 1 above, shall be approved before testing begins.
- D. Contractor's tests shall be scheduled and documented.

3.2 SITE VISITS

- A. The testing representative and technicians shall make periodic site visits as required to accomplish specified or necessary inspection of the equipment, installation, and testing to ensure compliance with specified requirements.
- B. Additional visits will be required if work is not ready for inspection or testing at the scheduled times. Notify the Government at least 14 days in advance of each site visit.
- C. The representative shall prepare written reports, documenting the results of each site visit as specified in "Submittals" in Part 1 above.

3.3 SYSTEM FUNCTIONAL TESTS

- A. Each system provided in this contract shall be functionally tested to ensure total system

operation.

- B. Upon completion of equipment tests, perform system functional tests. Functional tests shall demonstrate that when the system is activated, the proper interaction of all sensing, processing, and action devices will occur within the system such that the system will perform as it was specifically designed.
- C. Interlocks, safety device, fail-safe functions, and design functions shall be tested.
- D. The representative shall propose methods to initiate the sensing device by physical stimuli, and shall evaluate quantitatively the end result or output.
- E. Inspect, test, calibrate, and adjust:
 - 1. Medium voltage switchgear.
 - 2. Medium voltage vacuum circuit breakers.
 - 3. Protective relays.
 - 4. Instrument transformers.
 - 5. Switchboards.
 - 6. Unit substation transformers.
 - 7. Emergency generator.

3.4 MEDIUM- AND LOW-VOLTAGE SWITCHGEAR ASSEMBLIES

- A. Visual and mechanical inspection
 - 1. Compare equipment nameplate data with drawings and specifications.
 - 2. Inspect physical, electrical, and mechanical condition.
 - 3. Confirm correct application of manufacturer's recommended lubricants.
 - 4. Verify appropriate anchorage, required area clearances, physical damage, and correct alignment.
 - 5. Inspect all doors, panels, and sections for paint, dents, scratches, fit, and missing hardware.
 - 6. Verify that fuse and circuit breaker sizes and types correspond to drawings as well as to the circuit breaker's address for microprocessor-communication packages.
 - 7. Verify that current and potential transformer ratios correspond to drawings.
 - 8. Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data.
 - 9. Confirm correct operation and sequencing of electrical and mechanical interlock systems.
 - a. Attempt closure on locked-open devices. Attempt to open locked-closed devices.
 - b. Make key exchange with devices operated in off-normal positions.
 - 10. Clean switchgear.
 - 11. Inspect insulators for evidence of physical damage or contaminated surfaces.

12. Verify correct barrier and shutter installation and operation.
13. Exercise all active components.
14. Inspect all mechanical indicating devices for correct operation.
15. Verify that filters are in place and vents are clear.
16. Test operation, alignment, and penetration of instrument transformer withdrawal disconnects, current-carrying and grounding.
17. Inspect control power transformers.
 - a. Inspect physical damage, cracked insulation, broken leads, tightness of connections, defective wiring, and overall general condition.
 - b. Verify that primary and secondary fuse ratings or circuit breakers match drawings.
 - c. Verify correct functioning of drawout disconnecting and grounding contacts and interlocks.

B. Electrical tests

1. Perform tests on all instrument transformers.
2. Perform ground-resistance tests.
3. Perform resistance tests through all bus joints with a low-resistance ohmmeter. Any joints that cannot be directly measured due to permanently installed insulation wrap shall be indirectly measured from closest accessible connection.
4. Perform insulation-resistance tests on each bus section, phase-to-phase and phase-to-ground.
5. Perform an overpotential test on each bus section, each phase to ground with phases not under test grounded, in accordance with manufacturer's published data. The test voltage shall be applied for one minute.
6. Perform insulation-resistance tests at 1000 volts dc on all control wiring. Do not perform this test on wiring connected to solid-state components.
7. Perform current injection tests on the entire current circuit in each section of switchgear.
 - a. Perform current tests by primary injection, where possible, with magnitudes such that a minimum of 1.0 ampere flows in the secondary circuit.
 - b. Where primary injection is impractical, utilize secondary injection with a minimum current of 1.0 ampere.
 - c. Test current at each device.
8. Perform phasing check on switchgear to insure correct bus phasing from each source.
9. Perform the following tests on control power transformers.
 - a. Perform insulation-resistance tests. Perform measurements from winding-to-winding and each winding-to-ground. Test voltages shall be in accordance manufacturer's recommendations.
 - b. Perform secondary wiring integrity test. Disconnect transformer at secondary terminals and connect secondary wiring to correct secondary

- voltage. Confirm potential at all devices.
 - c. Verify correct secondary voltage by energizing primary winding with system voltage. Measure secondary voltage with the secondary wiring disconnected.
 - d. Verify correct function of control transfer relays located in switchgear with multiple power sources in following energized source for control power transformers.
 - 10. Potential transformer circuits:
 - a. Perform secondary wiring integrity test. Disconnect transformer at secondary terminals and connect secondary wiring to correct secondary voltage. Confirm correct potential at all devices.
 - b. Verify secondary voltage by energizing primary winding with system voltage. Measure secondary voltage with the secondary wiring disconnected.
 - 11. Verify operation of switchgear heaters.
- C. Test values:
 - 1. Compare bus connection resistances to values of similar connections.
 - 2. Insulation-resistance values for bus, control wiring, and control power transformers shall be in accordance with manufacturer's published data. Values of insulation resistance less than manufacturer's minimum should be investigated. Overpotential tests should not proceed until insulation-resistance levels are raised above minimum values.
 - 3. Apply overpotential test voltages in accordance with manufacturer's recommendations. The insulation shall withstand the overpotential test voltage applied.

3.5 MEDIUM-VOLTAGE VACUUM CIRCUIT BREAKERS

- A. Visual and mechanical inspection:
 - 1. Compare equipment nameplate data with drawings and specifications.
 - 2. Inspect physical and mechanical condition.
 - 3. Confirm correct application of manufacturer's recommended lubricants.
 - 4. Inspect anchorage, alignment, and grounding.
 - 5. Perform all mechanical operational tests on both the circuit breaker and its operating mechanism.
 - 6. Measure critical distances such as contact gap as recommended by manufacturer.
 - 7. Verify tightness of accessible bolted connections by calibrated torque-wrench method in accordance with manufacturer's published data.
 - 8. Record as-found and as-left operation counter readings.
- B. Electrical tests

1. Perform a contact-resistance test.
2. Verify trip, close, trip-free, and antipump function.
3. Trip circuit breaker by operation of each protective device.
4. Perform insulation-resistance tests pole-to-pole, pole-to-ground, and across open poles at 2500 volts minimum.
5. Perform vacuum bottle integrity (overpotential) test across each vacuum bottle with the breaker in the open position in strict accordance with manufacturer's instructions. Do not exceed maximum voltage stipulated for this test. Provide adequate barriers and protection against x-radiation during this test. Do not perform this test unless the contact displacement of each interrupter is within manufacturer's tolerance. (Be aware that some dc high-potential test sets are half-wave rectified and may produce peak voltages in excess of the breaker manufacturer's recommended maximum.)

C. Test values:

1. Bolt-torque levels shall be as specified by manufacturer.
2. Compare contact resistance to adjacent poles and similar breakers. Investigate deviations of more than 25 percent. Investigate any value exceeding manufacturer's tolerance.
3. Contact displacement shall be in accordance with factory recorded data marked on the nameplate of each vacuum breaker or bottle.
4. The interrupter shall withstand the overpotential voltage applied.
5. Compare circuit breaker travel and velocity values to manufacturer's acceptable limits.

3.6 PROTECTIVE RELAYS

A. Visual and mechanical inspection:

1. Compare equipment nameplate data with drawings and specifications.
2. Inspect relays and cases for physical damage. Remove shipping restraint material.
3. Tighten case connections. Inspect cover for correct gasket seal. Clean cover glass. Inspect shorting hardware, connection paddles, and knife switches. Remove any foreign material from the case. Verify target reset.
4. Set relays in accordance with coordination study.

B. Electrical tests:

1. Perform insulation-resistance test on each circuit-to-frame. Determine from the manufacturer's instructions the allowable procedures for this test for solid-state and microprocessor-based relays.
2. Inspect targets and indicators.
 - a. Verify operation of all light-emitting diode indicators.
3. Set contrast for liquid-crystal display readouts.

- C. Functional operation:
 - 1. 27 Undervoltage Relay
 - a. Determine dropout voltage.
 - b. Determine time delay.
 - c. Determine the time delay at a second point on the timing curve for inverse time relays.
 - 2. 50 Instantaneous Overcurrent Relay
 - a. Determine pickup.
 - b. Determine dropout.
 - c. Determine time delay.
 - 3. 51 Time Overcurrent
 - a. Determine minimum pickup.
 - b. Determine time delays at two points on the time current curve.
- D. Control verification: Verify that each of the relay contacts performs its intended function in the control scheme including breaker trip tests, close inhibit tests, 86 lockout tests, and alarm functions.
- E. System tests: After the equipment is initially energized, measure magnitude and phase angle of all inputs and compare to expected values.
- F. Test values:
 - 1. When not otherwise specified, use manufacturer's recommended tolerances.
 - 2. When critical test points are specified, the relay should be calibrated to those points even though other test points may be out of tolerance.

3.7 INSTRUMENT TRANSFORMERS

- A. Visual and mechanical inspection:
 - 1. Compare equipment nameplate data with drawings and specifications.
 - 2. Inspect physical and mechanical condition.
 - 3. Verify correct connection of transformers with system requirements.
 - 4. Verify that adequate clearances exist between primary and secondary circuit wiring.
 - 5. Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data.
 - 6. Verify that all required grounding and shorting connections provide contact.
 - 7. Verify correct operation of transformer withdrawal mechanism and grounding operation.
 - 8. Verify correct primary and secondary fuse sizes for potential transformers.

B. Electrical tests - current transformers:

1. Perform insulation-resistance test of the current transformer and wiring-to-ground at 1000 volts dc. Do not perform this test on solid-state devices.
2. Perform a polarity test of each current transformer.
3. Perform a ratio-verification test using the voltage or current method in accordance with ANSI C57.13.1 (IEEE Guide for Field Testing of Relaying Current Transformers).
4. Perform an excitation test on transformers used for relaying applications in accordance with ANSI C57.13.1. (IEEE Guide for Field Testing of Relaying Current Transformers).
5. Measure current circuit burdens at transformer terminals and determine the total burden.

C. Electrical tests - voltage transformers

1. Perform insulation-resistance tests winding-to-winding and each winding-to-ground. Test voltages shall be applied for one minute. Do not perform this test with solid-state devices connected.
2. Perform a polarity test on each transformer to verify the polarity marks or H1-X1 relationship as applicable.
3. Perform a turns ratio test on all tap positions, if applicable.
4. Measure potential circuit burdens at transformer terminals and determine the total burden.

D. Test values

1. Insulation-resistance measurement on any instrument transformer shall be not less than manufacturer's recommendations.
2. Polarity results shall agree with system drawings.
3. Compare measured burdens to calculated burdens supplied by owner.
4. Ratio accuracies shall be within 0.5 percent of nameplate or manufacturer's published data.
5. The insulation shall withstand the overpotential test voltage applied.

3.8 SWITCHBOARDS

A. Visual and Mechanical Inspection

1. Compare equipment nameplate data with drawings and specifications.
2. Inspect physical, electrical, and mechanical condition.
3. Verify appropriate anchorage, required area clearances, physical damage, and correct alignment.
4. Verify that circuit breaker sizes and types correspond to drawings.
5. Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data. Perform thermographic survey.
6. Clean switchgear.

7. Inspect insulators for evidence of physical damage or contaminated surfaces.
8. Exercise all active components.
9. Inspect all mechanical indicating devices for correct operation.

B. Electrical Tests

1. Perform ground-resistance tests.
2. Perform resistance tests through all bus joints with a low-resistance ohmmeter. Any joints that cannot be directly measured due to permanently installed insulation wrap shall be indirectly measured from closest accessible connection.
3. Perform insulation-resistance tests on each bus section, phase-to-phase and phase-to-ground.
4. Perform an overpotential test on each bus section, each phase to ground with phases not under test grounded, in accordance with manufacturer's published data.

C. Test Values:

1. Bolt-torque levels shall be as specified by manufacturer.
2. Compare bus connection resistances to values of similar connections.
3. Insulation-resistance values for bus shall be in accordance with manufacturer's published data. Values of insulation resistance less than manufacturer's minimum should be investigated. Overpotential tests should not proceed until insulation-resistance levels are raised above minimum values.
4. Apply overpotential test voltages in accordance with manufacturer's recommendations. The insulation shall withstand the overpotential test voltage applied.

3.9 UNIT SUBSTATION DRY TYPE TRANSFORMERS

A. Visual and Mechanical Inspection

1. Compare equipment nameplate data with drawings and specifications.
2. Inspect physical and mechanical condition.
3. Verify that control and alarm settings on temperature indicators are as specified.
4. Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data.
5. Perform specific inspections and mechanical tests as recommended by manufacturer.
6. Make a close examination for shipping brackets or fixtures that may not have been removed during installation. Ensure that resilient mounts are free.
7. Verify that winding core, frame, and enclosure groundings are correct.
8. Verify that as-left tap connections are specified.

B. Electrical Tests

1. Perform insulation-resistance tests winding-to-winding and each winding-to-ground.

2. Perform power-factor or dissipation-factor tests in accordance with the test equipment manufacturer's instructions.
3. Perform a turns-ratio test on all tap connections. Verify that winding polarities are in accordance with nameplate.
4. Perform an excitation-current test on each phase.
5. Measure the resistance of each winding at each tap connection.
6. Verify that core is solidly grounded. If core is insulated and a removable core ground strap is available, perform core insulation-resistance test at 500 volts dc.
7. Verify correct secondary voltage phase-to-phase and phase-to-neutral after energization and prior to loading.

C. Test Values

1. Insulation-resistance test values at one minute should not be less than 25,000 megohms.
2. Turns-ratio test results should not deviate more than one-half percent from either the adjacent coils or the calculated ratio.
3. C_H and C_L dissipation-factor/power-factor values will vary due to support insulators and bus work utilized on dry transformers. The following should be expected on C_{HL} power factors:
 - a. Power Transformers: two percent or less
 - b. Distribution Transformers: five percent or less
 - c. Consult transformer manufacturer's or test equipment manufacturer's data for additional information.
4. If winding-resistance test results vary more than one percent from adjacent windings, consult manufacturer.
5. Typical excitation current test data pattern for three-legged core transformer is two similar current readings and one lower current reading.
6. If core insulation resistance is less than one megohm at 500 volts dc, consult manufacturer.
7. AC overpotential test shall not exceed 75 percent of factory test voltage for one minute duration. DC overpotential test shall not exceed 100 percent of the factory RMS test voltage for one minute duration. The insulation shall withstand the overpotential test voltage applied.

3.10 EMERGENCY GENERATOR AND EXISTING PARALLELING SWITCHGEAR

A. Visual and mechanical inspection:

1. Compare equipment nameplate data with drawings and specifications.
2. Inspect physical and mechanical condition.
3. Inspect correct anchorage and grounding.

B. Electrical and mechanical tests:

1. Perform an insulation-resistance test on generator winding with respect to

- ground in accordance with ANSI/IEEE Standard 43. Calculate polarization index.
2. Test protective relay devices in accordance with previous sections of these specifications.
3. Perform phase-rotation test to determine compatibility with load requirements.
4. Functionally test engine shutdown for low oil pressure, overtemperature, overspeed, and other features as applicable.
5. Perform vibration baseline test. Plot amplitude versus frequency for each main bearing cap.
6. Conduct performance test in accordance with ANSI/NFPA Standard 110, Section 5-13 (Installation Acceptance).
7. Verify correct functioning of governor and regulator.
8. Verify correct functioning of existing paralleling switchgear.

C. Test values:

1. Polarization index values shall be in accordance with IEEE Standard 43.
2. Vibration levels shall be in accordance with manufacturer's published data.
3. Performance tests shall conform to manufacturer's published data.

3.11 TEST REPORTS

A. Submit test reports as required in "Submittals" in Part 1 above.

1. The test reports shall include the following:
 - a. Summary of project.
 - b. Description of equipment tested.
 - c. Description of test.
 - d. Test results.
 - e. Analysis and recommendations.

3.12 PLACING EQUIPMENT IN SERVICE

- A. The testing organization's representative shall be present when equipment tested by the organization is initially energized and placed in the service.

3.13 TRAINING

- A. Training of the Government's operation and maintenance (O&M) personnel is required. Provide competent, factory-authorized personnel to provide instruction to O&M personnel concerning the location, operation, and troubleshooting of the installed systems. The instruction shall be scheduled in coordination with the Government after submission and approval of formal training plans.

END OF SECTION 16950

END OF SPECIFICATIONS

ATTACHMENTS

General Decision Number: DC070001 02/09/2007 DC1

Superseded General Decision Number: DC20030001

State: District of Columbia

Construction Types: Heavy (Heavy and Sewer and Water Line)
and Highway

County: District of Columbia Statewide.

HEAVY CONSTRUCTION PROJECTS (Including Sewer and Water Lines);
HIGHWAY CONSTRUCTION PROJECTS

Modification Number	Publication Date
0	02/09/2007

* ASBE0024-001 10/01/2006

	Rates	Fringes
Asbestos Worker/Heat and Frost Insulator		
Includes the application of all insulating materials, protective coverings, coatings and finishes to all types of mechanical systems.....	\$ 27.13	13.13

* ASBE0024-002 10/01/2006

	Rates	Fringes
Hazardous Material Handler		
Includes preparation, wetting, stripping, removal, scrapping, vacuuming, bagging and disposing of all insulation materials, whether they contain asbestos or not, from mechanical systems.....	\$ 18.00	6.45

* ASBE0024-005 10/01/2006

	Rates	Fringes
Fire Stop Technician		
Includes the application of materials or devices within or around penetrations and openings in all rated wall or floor		

assemblies, in order to prevent the passage of fire, smoke or other gases. The application includes all components involved in creating the rated barrier at perimeter slab edges and exterior cavities, the head of gypsum board or concrete walls, joints between rated wall or floor components, sealing of penetrating items and blank openings.....\$ 22.00

6.24

BOIL0193-001 10/01/2006

	Rates	Fringes
Boilermaker.....	\$ 32.06	16.46

BRDC0001-001 04/30/2006

	Rates	Fringes
Bricklayer.....	\$ 25.90	6.19

CARP0132-001 05/01/2006

	Rates	Fringes
Carpenter/Lather.....	\$ 23.37	5.75
Piledriver.....	\$ 22.47	6.00

CARP0132-003 05/01/2004

	Rates	Fringes
Diver Tender.....	\$ 20.85	5.50
Diver.....	\$ 29.63	5.50

CARP1831-001 04/01/2003

	Rates	Fringes
Millwright.....	\$ 24.34	4.05

ELEC0026-001 11/06/2006

	Rates	Fringes
Electrician.....	\$ 32.45	11.32+a

a. PAID HOLIDAYS: New Year's Day, Martin Luther King Jr.'s Birthday, Inauguration Day, Memorial Day, Fourth of July, Labor Day, Veterans Day, Thanksgiving Day, the day after

Thanksgiving and Christmas Day or days designated as legal holidays by the Federal Government.

ELEC0026-008 07/01/2003

	Rates	Fringes
Motor Repairmen		
Removal and reinstallation		
of electrical motors.....	\$ 23.69	7.73+3%+a

a. PAID HOLIDAYS:

New Year's Day, Martin Luther King Jr.'s Birthday, Inauguration Day, Memorial Day, Fourth of July, Labor Day, Veterans Day, Thanksgiving Day, the day after Thanksgiving and Christmas Day or days designated as legal holidays by the Federal Government.

ELEC0070-001 01/01/2006

	Rates	Fringes
Line Construction:		
Groundmen.....	\$ 12.03	4.75+18.75%
Linemen, Cable Splicers,		
Equipment Operators.....	\$ 25.50	4.75+18.75%
Truck with winch.....	\$ 12.35	4.75+18.75%

ENGI0077-001 05/01/2006

	Rates	Fringes
Power equipment operators:		
(HEAVY AND HIGHWAY		
CONSTRUCTION)		
GROUP 1.....	\$ 26.69	6.42+a+b
GROUP 2.....	\$ 26.23	6.42+a+b
GROUP 3.....	\$ 25.52	6.42+a
GROUP 4.....	\$ 23.49	6.42+a
GROUP 5.....	\$ 18.95	6.42+a
GROUP 6.....	\$ 28.06	6.42+a

POWER EQUIPMENT OPERATORS CLASSIFICATIONS

GROUP 1: 35 ton cranes & above, tower & climbing cranes, derricks, concrete boom pump, drill rigs (equivalent to L & Double L), mole.

GROUP 2: Backhoes, cableways, cranes, cherry pickers, elevating graders, hoists, paving mixers, power shovels, tunnel shovels. batch plants, shields, tunnel mining machines, gradalls, front end loaders, 3 1/2 cu. yds. and above, power driven wheel scoops and scrapers (50 cu. yds. struck capacity or above), rail tamper, draglines, boomcat, mucking machines, graders in tunnels, pile driving engines.

GROUP 3: Front end loaders below 3 1/2 cu. yds, boom trucks, hydraulic backhoes 1/2 yds. capacity or below rubber or track mounted, tug boats, power driven wheel scoops & scrapers, blade graders, motor graders, bulldozers, trenching machines, concrete mixer, speed swing pettibone, ballast regulator, concrete pump, mechanic, welder, mechanic welder, shotcrete machines, Hoeram, locomotive (standard, narrow gauge), tuggers.

GROUP 4: High lifts above 10 feet, boilers (skelton), asphalt spreaders, bullfloat finishing machines, concrete finishing machines, concrete spreaders, fine graders, air compressors, welding machines, pumps, generators, well points, deep wells, hydraulic pumps, elevators, freeze uniits, tunnel motorman or dinky operator, roller, conveyors, well drilling machines, grout pump, fireman.

GROUP 5: Fork lifts, ditch witch, bobcat 1/3 cu. yd. and below, space heaters, sweepers, assistant engineers, oilers.

GROUP 6: Master mechanic.

a. PAID HOLIDAYS: New Years Day, Inaugural Day, Decoration Day, Independence Day, Labor Day, Martin Luther King's Birthday, Veterans' Day, Thanksgiving Day, Friday after Thanksgiving and Christmas Day.

b. PREMIUM PAY: Tower cranes and cranes 100-ton and over to receive \$1.00 per hour premium over Group One.

ENGI0077-002 06/01/2006

	Rates	Fringes
Power equipment operators: (PAVING AND INCIDENTAL GRADING)		
GROUP 1.....	\$ 21.50	5.25
GROUP 2.....	\$ 19.05	5.25
GROUP 3.....	\$ 17.80	5.25
GROUP 4.....	\$ 16.59	5.25
GROUP 5.....	\$ 15.35	5.25
GROUP 6.....	\$ 21.45	5.25

POWER EQUIPMENT OPERATORS CLASSIFICATIONS

GROUP 1: Gradall operator, Crane.

GROUP 2: Boom Truck, Milling Machine, Excavator, Rubber Tire Backhoe, Asphalt Paver, Asphalt Plant Engineer.

GROUP 3: Motor Grader, Track Loader, Rubber Tire Loader, Track Dozer, Concrete Paver.

GROUP 4: Broom Truck, Asphalt Roller.

GROUP 5: Air Compressor, Grade Rollers.

GROUP 6: Mechanic.

ENGI0077-003 07/01/2006

	Rates	Fringes
Power equipment operators: (SEWER, GAS AND WATER LINE CONSTRUCTION)		
GROUP 1.....	\$ 19.43	5.12+a
GROUP 2.....	\$ 19.03	5.12+a
GROUP 3.....	\$ 18.88	5.12+a
GROUP 4.....	\$ 18.80	5.12+a
GROUP 5.....	\$ 18.69	5.12+a
GROUP 6.....	\$ 18.52	5.12+a
GROUP 7.....	\$ 18.62	5.12+a
GROUP 8.....	\$ 18.52	5.12+a
GROUP 9.....	\$ 19.06	5.12+a
GROUP 10.....	\$ 18.41	5.12+a
GROUP 11.....	\$ 18.29	5.12+a
GROUP 12.....	\$ 18.20	5.12+a

POWER EQUIPMENT OPERATORS CLASSIFICATIONS

GROUP 1: Backhoes, Cableways, Cranes, Derricks, Draglines, Power Shovels, Tunnel Shovels, Tunnel Mucking Machines (1 cubic yard capacity or above).

GROUP 2: Backhoes, Boom Cats, Cableways, Cranes, Derricks, Draglines, Elevating Graders, Hoists, Paving Mixers, Pile Driving Engines, Power and Tunnel Shovels, Tunnel Mucking Machines, Batch Plant, Concrete Pumps.

GROUP 3: Operators of Hydraulic Backhoes of below 1/2 yard capacity.

GROUP 4. Trenching machines above 83 inches.

GROUP 5: Trenching machines (up to & including 83"), Boilers (Skelton), Well Drilling Machines.

GROUP 6: Air Compressors (Tunnel).

GROUP 7: Front-end Loaders (Hi-Lift) and Bulldozers on Sewer and Water Line Work.

GROUP 8: Concrete Mixers, Power Driven Wheel Scoops and Scrapers, Blade graders, Motor Graders, Tunnel Mechanics, Tunnel Motormen.

GROUP 9: Mechanics.

GROUP 10: Bulldozers, Hydraulic Tamper and Hoe Pack Operators.

GROUP 11: Rollers.

GROUP 12: Air Compressors, Pumps, Welding Machines, Well Points.

a. PAID HOLIDAYS: New Year's Day, Inaugural Day, Washington's Birthday, Decoration Day, Independence Day, Labor Day,

Veterans Day, Thanksgiving Day, Christmas Day and Martin
Luther King's Birthday.

IRON0005-001 06/01/2006

	Rates	Fringes
Ironworkers:		
Structural, Ornamental and		
Chain Link Fence.....	\$ 25.68	11.345

IRON0201-001 05/01/2006

	Rates	Fringes
Ironworkers:		
Reinforcing.....	\$ 23.45	12.08

LABO0456-006 06/01/2006

	Rates	Fringes
Laborers: (BRICK MASONRY WORK)		
Mason Tenders.....	\$ 13.91	3.84
Scaffold Builders,		
Mortarmen and Small		
Equipment Operators.....	\$ 14.65	3.84

LABO0657-003 06/01/2006

	Rates	Fringes
Laborers: (HEAVY AND HIGHWAY AND SEWER & WATER LINES CONSTRUCTION)		
GROUP 1.....	\$ 19.18	3.84
GROUP 2.....	\$ 19.46	3.84
GROUP 3.....	\$ 19.61	3.84
GROUP 4.....	\$ 19.75	3.84
GROUP 5.....	\$ 20.15	3.84
GROUP 6.....	\$ 20.64	3.84
GROUP 7.....	\$ 21.11	3.84
GROUP 8.....	\$ 21.77	3.84

LABORERS CLASSIFICATIONS:

GROUP 1: Carloaders, choker setter, concrete crewman, crushed
feeder, demolition laborers, including salvaging all material,
loading, cleaning up, wrecking, dumpmen, flagmen, fence
erector and installer (other than chain link), including
installation and erection of fence, guard rails, medial rails,
reference posts, guide posts and right-of-way markers, form
strippers, general laborers, railroad track laborers, riprap
man, scale man, stake jumper, structure mover, includes
foundation, separation, preparation, cribbing, shoring,
jacking and unloading of structures, water nozzleman, timber
bucker and faller, truck loader, water boys, tool room men.

GROUP 2: Combined air and water nozzleman, cement handler, dope pot fireman (nonmechanical), form cleaning machine, mechanical railroad equipment (includes spiker, puller, tile cleaner, tamper, pipe wrapper, power driven wheelbarrows, operators of hand derricks, towmasters, scootcretes, buggymobiles and similar equipment), tamper or rammer operator, trestle scaffold builders over one tier high, power tool operator (gas, electric or pneumatic), sandblast or gunnite tailhose man, scaffold erector, (steel or wood), vibrator operator (up to 4 feet), asphalt cutter, mortar men, shorer and lagger, creosote material handler, corrosive enamel or equl, paver breaker and jackhammer operators.

GROUP 3: Multi-section pipe layer, non-metallic clay and concrete pipe layer (including caulker, collarman, jointer, rigger and jacker, thermal welder and corrugated metal culvert pipe layer.

GROUP 4: Asphalt block pneumatic cutter, asphalt roller, walker, chainsaw operator with attachment, concrete saw (walking), high scalers, jackhammer operator (using over 6 feet of steel), vibrator operator (4 feet and over), well point installer, air trac operator.

GROUP 5: Asphalt screeder, big drills, cut of the hole drills (1 1/2 " piston or larger), down the hole drills (3 1/2" piston or larger) gunnite or sandblaster nozzleman, asphalt raker, asphalt tamper, form setter, demolition torch operator, shotcrete nozzlemen and potman.

GROUP 6: Powderman, master form setters.

GROUP 7: Brick paver (asphalt block paver, asphalt block sawman, asphalt block grinder, hasting's block or similar type)

GROUP 8: Licensed powdermen.

LABO0657-004 06/01/2006

	Rates	Fringes
Laborers: (HAZARDOUS WASTE REMOVAL, EXCEPT ON MECHANICAL SYSTEMS: Preparation for, removing and encapsulation of hazardous materials from non-mechanical systems)		
Skilled Asbestos Abatement Laborers.....	\$ 15.99	3.84
Skilled Toxic and Hazardous Waste Removal Laborers.....	\$ 18.61	3.84

LABO0657-005 06/01/2006

	Rates	Fringes
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Laborers: (TUNNEL, RAISE &
SHAFT (FREE AIR)
FOR HEAVY AND SEWER & WATER
LINES CONSTRUCTION)

GROUP 1.....	\$ 19.82	3.84
GROUP 2.....	\$ 20.39	3.84
GROUP 3.....	\$ 21.85	3.84
GROUP 4.....	\$ 22.47	3.84

LABORERS CLASSIFICATIONS:

GROUP 1: Brakeman, Bull Gang, Dumper, Trackmen, Concrete Man.

GROUP 2: Chuck Tender, Powdermen in Prime House, Form Setters
and Movers, Nippers, Cableman, Houseman, Groutman, Bell or
Signalman, Top or Bottom Vibrator Operator.

GROUP 3: Miners, Re-Bar Underground, Concrete or Gunnite
Nozzlemen, Powdermen, Timbermen and Re-Timbermen, Wood Steel
Including Liner plate or Other Support, Material Motorman,
Caulkers, Diamond Drill Operators, Riggers, Cement Finishers-
Underground, Welders and Burners, Shield Driver, Air Trac
Operator, Shotcrete Nozzlemen and Potman.

GROUP 4: Mucking Machine Operator (Air).

LABO0657-006 06/01/2006

	Rates	Fringes
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Laborers: (TUNNEL, RAISE AND
SHAFT (COMPRESSED AIR) FOR
HEAVY CONSTRUCTION ONLY

Gauge Pressure Work Period
(Pounds) (Hours)

1-14	7.....	\$ 24.16	3.84
14-18	6.....	\$ 28.43	3.84

FOOTNOTE: On any requirement for air pressure in excess of 18
PSI, work periods and rates should be negotiated at a
pre-bid conference.

LABO0657-007 06/01/2006

	Rates	Fringes
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Laborers: (PAVING AND
INCIDENTAL GRADING)

Asphalt Raker & Concrete Saw Operator.....	\$ 16.76	4.10
Asphalt Shoveler.....	\$ 16.23	4.10
Asphalt Tammer & Concrete Shoveler.....	\$ 16.47	4.10
Jack Hammer.....	\$ 16.66	4.10
Laborer.....	\$ 16.12	4.10
Sand Setter & Form Setter...	\$ 17.37	4.10

MARB0002-003 05/01/2006

	Rates	Fringes
Marble & Stone Mason Includes Pointing, Caulking and Cleaning of All Types of Masonry, Brick, Stone and Cement Structures.....	\$ 29.87	11.15

MARB0003-001 05/01/2006

	Rates	Fringes
Mosaic & Terrazzo Worker, Tile Layer Marble Mason and Tile Layer..	\$ 24.32	8.78
Terrazzo Worker.....	\$ 25.07	8.78

MARB0003-004 05/01/2006

	Rates	Fringes
Marble, Tile & Terrazzo Finisher.....	\$ 19.59	7.90

PAIN0051-001 06/01/2006

	Rates	Fringes
Painters: All Industrial Work.....	\$ 23.48	7.31
Bridges, Heavy Highway, Lead Abatement and Flame/Thermal Spray.....	\$ 26.37	7.31
Commercial and Mold Remediation, Painters, Wallcovers and Drywall Finishers.....	\$ 22.06	7.31
Metal Polishing and Refinishing.....	\$ 23.06	7.31

PLAS0891-001 05/01/2006

	Rates	Fringes
Cement Masons: HEAVY CONSTRUCTION ONLY.....	\$ 25.45	5.46

PLAS0891-002 06/01/2004

	Rates	Fringes
Cement Masons: (PAVING & INCIDENTAL GRADING)		

Cement Masons.....	\$ 16.25	4.10
Concrete Saw Operators.....	\$ 16.25	4.10
Form Setters.....	\$ 16.25	4.10

PLUM0005-001 08/01/2006

	Rates	Fringes
Plumber.....	\$ 31.52	12.59+a

a. PAID HOLIDAYS: Labor Day, Veterans' Day, Thanksgiving Day and the day after Thanksgiving, Christmas Day, New Year's Day, Martin Luther King's Birthday, Memorial Day and the Fourth of July.

PLUM0602-005 08/01/2006

	Rates	Fringes
Steamfitter, Refrigeration & Air Conditioning Mechanic.....	\$ 31.27	12.82+a

a. PAID HOLIDAYS: New Year's Day, Martin Luther King's Birthday, Memorial Day, Independence Day, Labor Day, Veterans Day, Thanksgiving Day and the day after Thanksgiving and Christmas Day.

SHEE0100-001 07/01/2006

	Rates	Fringes
Sheet Metal Worker.....	\$ 30.39	11.05

TEAM0639-001 03/07/2004

	Rates	Fringes
Truck drivers: (HEAVY & HIGHWAY CONSTRUCTION) Tandem & Triaxle (3 or more axles, including steering axle).....	\$ 16.00	5.82+a
Tractor-trailer, Low Boy....	\$ 20.00	5.82+a

a. VACATION: Employees will receive one (1) week's paid vacation after one (1) year of service.

TEAM0639-002 06/01/2005

	Rates	Fringes
Truck drivers: (HEAVY & HIGHWAY CONSTRUCTION) Concrete Mixer Drivers.....	\$ 17.40	5.82+a+b

a. PAID HOLIDAYS: New Year's Day, Martin Luther King, Jr. Day, Memorial Day, July 4th, Labor Day, Thanksgiving Day,

Christmas Day, or any day celebrated publicly in the District of Columbia as one of the above holidays.

b. PAID VACATIONS: Employees with one (1) year of service shall be entitled to a vacation of one (1) week; five (3) years of service are entitled to two (2) weeks; fifteen (10) years of service are entitled to three (3) weeks; twenty (20) years of service are entitled to four (4) weeks.

TEAM0639-005 09/01/2006

	Rates	Fringes
Truck drivers: (PAVING & INCIDENTAL GRADING)		
All paving projects where the grading is incidental to the paving.....	\$ 14.05	3.69

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

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Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (ii)).

In the listing above, the "SU" designation means that rates listed under the identifier do not reflect collectively bargained wage and fringe benefit rates. Other designations indicate unions whose rates have been determined to be prevailing.

WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

- * an existing published wage determination
- * a survey underlying a wage determination
- * a Wage and Hour Division letter setting forth a position on a wage determination matter
- * a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour Regional Office for the area in which the survey was conducted because those Regional Offices have responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

4.) All decisions by the Administrative Review Board are final.

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END OF GENERAL DECISION

BID BOND <i>(See instruction on reverse)</i>	DATE BOND EXECUTED <i>(Must not be later than bid opening date)</i>	OMB NO.:9000-0045
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Public reporting burden for this collection of information is estimated to average 25 minutes per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to the FAR Secretariat (MVR), Federal Acquisition Policy Division, GSA, Washington, DC 20405.

PRINCIPAL <i>(Legal name and business address)</i>	TYPE OF ORGANIZATION <i>("X" one)</i>	
	<input type="checkbox"/> INDIVIDUAL	<input type="checkbox"/> PARTNERSHIP
	<input type="checkbox"/> JOINT VENTURE	<input type="checkbox"/> CORPORATION
		STATE OF INCORPORATION

SURETY(IES) *(Name and business address)*

PENAL SUM OF BOND					BID IDENTIFICATION	
PERCENT OF BID PRICE	AMOUNT NOT TO EXCEED				BID DATE FOR <i>(Construction, Supplies, or Services)</i>	INVITATION NO.
	MILLION(S)	THOUSAND(S)	HUNDRED(S)	CENTS		

OBLIGATION:

We, the Principal and Surety(ies) are firmly bound to the United States of America (hereinafter called the Government) in the above penal sum. For payment of the penal sum, we bind ourselves, our heirs, executors, administrators, and successors, jointly and severally. However, where the Sureties are corporations acting as co-sureties, we, the Sureties, bind ourselves in such sum "jointly and severally" as well as "severally" only for the purpose of allowing a joint action or actions against any or all of us. For all other purposes, each Surety binds itself, jointly and severally with the Principal, for the payment of the sum shown opposite the name of the Surety. If no limit of liability is indicated, the limit of liability is the full amount of the penal sum.

CONDITIONS:

The Principal has submitted the bid identified above.

THEREFORE:

The above obligation is void if the Principal - (a) upon acceptance by the Government of the bid identified above, within the period specified therein for acceptance (sixty (60) days if no period is specified), executes the further contractual documents and gives the bond(s) required by the terms of the bid as accepted within the time specified (ten (10) days if no period is specified) after receipt of the forms by the principal; or (b) in the event of failure to execute such further contractual documents and give such bonds, pays the Government for any cost of procuring the work which exceeds the amount of the bid.

Each Surety executing this instrument agrees that its obligation is not impaired by any extension(s) of the time for acceptance of the bid that the Principal may grant to the Government. Notice to the surety(ies) of extension(s) are waived. However, waiver of the notice applies only to extensions aggregating not more than sixty (60) calendar days in addition to the period originally allowed for acceptance of the bid.

WITNESS:

The Principal and Surety(ies) executed this bid bond and affixed their seals on the above date.

PRINCIPAL						
SIGNATURE(S)	1.	2.	3.			
	<i>(Seal)</i>	<i>(Seal)</i>	<i>(Seal)</i>			
NAME(S) & TITLE(S) <i>(Typed)</i>	1.	2.	3.		Corporate Seal	
INDIVIDUAL SURETY(IES)						
SIGNATURE(S)	1.	2.				
		<i>(Seal)</i>	<i>(Seal)</i>			
NAME(S) <i>(Typed)</i>	1.	2.				
CORPORATE SURETY(IES)						
SURETY A	NAME & ADDRESS			STATE OF INC.	LIABILITY LIMIT (\$)	Corporate Seal
	SIGNATURE(S)	1.	2.			
	NAME(S) & TITLE(S) <i>(Typed)</i>	1.	2.			

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Previous edition is usable

STANDARD FORM 24 (REV. 10-98)
Prescribed by GSA - FAR (48 CFR) 53.228(a)

SURETY B	NAME & ADDRESS		STATE OF INC.	LIABILITY LIMIT (\$)	Corporate Seal
	SIGNATURE(S)	1.	2.		
	NAME(S) & TITLE(S) (Typed)	1.	2.		
SURETY C	NAME & ADDRESS		STATE OF INC.	LIABILITY LIMIT (\$)	Corporate Seal
	SIGNATURE(S)	1.	2.		
	NAME(S) & TITLE(S) (Typed)	1.	2.		
SURETY D	NAME & ADDRESS		STATE OF INC.	LIABILITY LIMIT (\$)	Corporate Seal
	SIGNATURE(S)	1.	2.		
	NAME(S) & TITLE(S) (Typed)	1.	2.		
SURETY E	NAME & ADDRESS		STATE OF INC.	LIABILITY LIMIT (\$)	Corporate Seal
	SIGNATURE(S)	1.	2.		
	NAME(S) & TITLE(S) (Typed)	1.	2.		
SURETY F	NAME & ADDRESS		STATE OF INC.	LIABILITY LIMIT (\$)	Corporate Seal
	SIGNATURE(S)	1.	2.		
	NAME(S) & TITLE(S) (Typed)	1.	2.		
SURETY G	NAME & ADDRESS		STATE OF INC.	LIABILITY LIMIT (\$)	Corporate Seal
	SIGNATURE(S)	1.	2.		
	NAME(S) & TITLE(S) (Typed)	1.	2.		

INSTRUCTIONS

1. This form is authorized for use when a bid guaranty is required. Any deviation from this form will require the written approval of the Administrator of General Services.
2. Insert the full legal name and business address of the Principal in the space designated "Principal" on the face of the form. An authorized person shall sign the bond. Any person signing in a representative capacity (e.g., an attorney-in-fact) must furnish evidence of authority if that representative is not a member of the firm, partnership, or joint venture, or an officer of the corporation involved.
3. The bond may express penal sum as a percentage of the bid price. In these cases, the bond may state a maximum dollar limitation (e.g., 20% of the bid price but the amount not to exceed _____ dollars).
4. (a) Corporations executing the bond as sureties must appear on the Department of the Treasury's list of approved sureties and must act within the limitation listed therein. Where more than one corporate surety is involved, their names and addresses shall appear in the spaces (Surety A, Surety B, etc.) headed "CORPORATE SURETY(IES)." In the space designated "SURETY(IES)" on the face of the form, insert only the letter identification of the sureties.
(b) Where individual sureties are involved, a completed Affidavit of Individual surety (Standard Form 28), for each individual surety, shall accompany the bond. The Government may require the surety to furnish additional substantiating information concerning its financial capability.
5. Corporations executing the bond shall affix their corporate seals. Individuals shall execute the bond opposite the word "Corporate Seal"; and shall affix an adhesive seal if executed in Maine, New Hampshire, or any other jurisdiction requiring adhesive seals.
6. Type the name and title of each person signing this bond in the space provided.
7. In its application to negotiated contracts, the terms "bid" and "bidder" shall include "proposal" and "offeror."

**** NOTICE ****

TO: ALL VENDORS/CONTRACTORS/CONSULTANTS

FROM: THE OFFICE OF THE ARCHITECT OF THE CAPITOL

Due to requirements set forth in the DEBT COLLECTION IMPROVEMENT ACT OF 1996 (PUBLIC LAW 104-134), all payments made to vendors, contractors and consultants doing business with the Federal Government must be made by Electronic Funds Transfer (EFT) directly to your financial institution. If you are currently enrolled under EFT with the Architect of the Capitol, no further action is necessary other than to report changes.

EFT payments are cost effective, enabling prompt, convenient and reliable payments directly to a designated bank account.

The Architect of the Capitol, in making EFT payments, supplies the financial institution with identifying information (ie. invoice number), which accompanies each transaction. The financial institution in turn can supply this information to the account holder.

Therefore, to accomplish the mandate of P. L. 104-134, it is necessary that the attached sheet; PAYMENT INFORMATION FORM ACH VENDOR PAYMENT SYSTEM be completed and returned with your bid or offer as set forth in Section G of the solicitation.

**PAYMENT INFORMATION FORM
ACH VENDOR PAYMENT SYSTEM**

This form is used for ACH payments with an addendum record that carries payment-related information. Recipients of these payments should bring this information to the attention of their financial institution when presenting this form for completion. The information will be transmitted in the CCD+ format to the designated financial institution.

Debt Collection Improvement Act of 1996

PAPERWORK REDUCTION ACT STATEMENT

The information being collected on this form is pursuant to Public Law 104-134, which mandated Electronic Funds Transfer for recipients of all federal payments (excluding IRS tax refunds) beginning July 24, 1996. This information will be needed by the Treasury Department to transmit payments and related data.

COMPANY INFORMATION

NAME:

ADDRESS:

CONTRACT NUMBER: **AOC-**_____

TAXPAYER IDENTIFICATION NUMBER (TIN):

CONTACT PERSON NAME:

TELEPHONE NUMBER: ()

FAX NUMBER: ()

AGENCY INFORMATION

NAME: ARCHITECT OF THE CAPITOL - FORD HOUSE OFFICE BUILDING

ADDRESS: ACCOUNTING DIVISION, ROOM H2-205

WASHINGTON, D.C. 20024

FAX NUMBER: (202) 225-7321

CONTACT PERSON NAME: MR. JAMES JARBOE

TELEPHONE NUMBER: (202) 226-2552

FINANCIAL INSTITUTION INFORMATION

BANK NAME:

BRANCH LOCATION: (If applicable)

CONTACT NAME:

TELEPHONE NUMBER: ()

NINE DIGIT ROUTING TRANSIT NUMBER: _ _ _ _ _

DEPOSITOR ACCOUNT NUMBER:

TYPE OF ACCOUNT: _ _ _ _ CHECKING _ _ _ _ SAVINGS _ _ _ _ LOCKBOX

SIGNATURE AND TITLE OF REPRESENTATIVE:

TELEPHONE NUMBER:



UNITED STATES CAPITOL POLICE
WASHINGTON, D.C. 20510-7218

CP-491
(4-04)

REQUEST FOR CHECK OF CRIMINAL HISTORY RECORDS

Please report with: (1) A valid form of photo identification, (2) and this form to the Fairchild Building located at 499 South Capitol Street SW Washington, D.C., Room 127 between the hours of 7am until 3pm Monday through Friday for processing.

1. Name: (Last, First, Middle) _____ Address: _____
Street & No. _____
City & State: _____
Zip: _____ Tele: _____

2. Other Names Ever Used: (e.g. maiden name, nickname, ect. If you have never used another name write "None".)

3. Date of Birth: (Month, Day, Year) _____ 4. Birthplace: (City and State or Country) _____

5. Social Security Number: _____ 6. Gender: _____
Male Female

7. Race: _____ 8. Height: _____ 9. Weight: _____ 10. Eye Color: _____ 11. Hair Color: _____

SIGNATURE AND RELEASE OF INFORMATION:

READ THE FOLLOWING CAREFULLY BEFORE YOU SIGN:

- I understand that the information provided above will be used to check the criminal history records of the Federal Bureau of Investigation (FBI).
- I consent to the use of the information provided in making a security determination concerning me.
- I certify that, to the best of my knowledge and belief, all of the information provided above is true, correct, and complete, made in good faith.

12. Signature: _____ 13. Date: _____